



U.S. Department of Energy  
**Office of River Protection**

P.O. Box 450, MSIN H6-60  
Richland, Washington 99352

0078556

JUL 30 2008

08-ESQ-175

Mr. John Martell, Manager  
Radioactive Air Emissions Section  
Washington State Department of Health  
309 Bradley Blvd., Suite 201  
Richland, Washington 99352  
(Hanford Mailstop: B1-42)

**RECEIVED**  
JUL 31 2008  
**EDMC**

Dear Mr. Martell:

REQUEST FOR APPROVAL OF MODIFICATION TO THE RADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION (NOC) AND APPROVAL ORDER FOR INSTALLATION OF BREATHER FILTERS ON MISCELLANEOUS TANKS AND AMENDMENT TO HANFORD SITE AIR OPERATING PERMIT (AOP) FOR EMISSION UNIT 200W C-296S302

The U.S. Department of Energy, Office of River Protection requests the Washington State Department of Health review the attached documents "Radioactive Air Emissions Notice of Construction Application for Installation of Breather Filters on Miscellaneous Tanks," (Attachment 1) and "Hanford Site Air Operating Permit, Notification of Off-Permit Change Permit Number 00-05-006 Renewal 1," (Attachment 2). This modification is being submitted in compliance with Washington Administrative Code 173-246-247 "Washington Administrative Code 246-247, Radiation Protection – Air Emissions," as amended, and the AOP.

The attachments include a request for inclusion of breather filter installation and operation on catch tank 241-S-302 as a revision to the existing NOC. No actual increase in radiological emissions is expected to occur with utilization of breather filters. Catch tank 241-S-302 catch tank is an existing unit which emissions are largely fugitive. The addition of a breather filter will not actually increase emissions, but will channel them to a controlled point source.

Administratively, the NOC will see an increase in the potential Annual Possession Quantity and associated Potential to Emit (PTE) with the inclusion of the inventory in this additional catch tank. The PTE identified in the NOC changes from 2.73E-04 mrem/yr to 1.88E-01 mrem/yr.


Mr. John Martell  
08-ESQ-175

-2-

JUL 30 2008

If you have any questions, please contact me, or your staff may contact Dennis W. Bowser, Environmental Compliance Division, (509) 373-2566.

Sincerely,



Shirley J. Olinger, Manager  
Office of River Protection

ESQ:DWB

Attachments: (2)

cc w/attachs:

O. S. Wang, Ecology  
D. Zhen, EPA (Seattle)  
N. A. Homan, FHI  
J. Schmidt, WDOH Richland Office  
**Administrative Record**  
BNI Correspondence  
CH2M HILL Correspondence  
Environmental Portal, LMSI

cc w/o attachs:

B. G. Erlandson, BNI  
R. D. Haggard, BNI  
J. C. Fulton, CH2M HILL  
C. J. Kemp, CH2M HILL  
P. C. Miller, CH2M HILL  
L. L. Penn, CH2M HILL  
J. Cox, CTUIR  
S. Harris, CTUIR  
B. Becker-Khaleel, Ecology  
S. L. Dahl, Ecology  
J. L. Hensley, Ecology  
J. A. Bates, FHI  
G. Bohnie, NPT  
K. Niles, Oregon Energy  
M. F. Jarvis, RL  
R. Jim, YN

**Attachment 1**  
**08-ESQ-175**

**Radioactive Air Emissions Notice of Construction Application for  
Installation of Breather Filters on Miscellaneous Tanks**

Radioactive Air Emissions Notice of Construction Application for Installation and Operation of  
Breather Filters on Miscellaneous Tanks

**RADIOACTIVE AIR EMISSIONS NOTICE OF  
CONSTRUCTION APPLICATION FOR INSTALLATION  
OF BREATHER FILTERS ON MISCELLANEOUS  
TANKS**

**L. L. Penn**  
CH2M HILL Hanford Group, Inc.

**Date Published**  
July 2008



**CH2MHILL**  
*Hanford Group, Inc.*

Post Office Box 1500  
Richland, Washington

Prepared for the U.S. Department of Energy  
Office of River Protection

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**Approved for Public Release; Further Dissemination Unlimited**



Radioactive Air Emissions Notice of Construction Application for Installation and Operation of  
Breather Filters on Miscellaneous Tanks

## INTRODUCTION

This document serves as a notice of construction pursuant to the requirements of *Washington Administrative Code* 246-247-060, "Radiation Protection Air Emissions," and as a request for approval to construct pursuant to Title 40, *Code of Federal Regulations*, Part 61.07, "Application for Approval of Construction or Modification" for the installation and operation of a breather filter on the 241-UX-302A.

Revision 1 adds the installation and operation of a breather filter on the 241-AZ-154, and 241-U-301B catch tanks.

Revision 2 adds the installation and operation of a breather filter on the 241-S-302 catch tank

Catch tanks 241-UX-302A and 241-U-301B were removed from service in 2005 and will be isolated in 2006. Catch Tank 241-AZ-154 which was removed from service in 1992 will also be isolated in 2006. Catch Tank 241-S-302 was removed from service and isolated in 1987. Isolation precludes barometric breathing of the catch tank, which could allow concentrations of flammable gases to eventually reach the lower flammability limit. Therefore, installation of a breather filter on each catch tank is planned to allow barometric breathing to continue following isolation.

A conservative estimated potential total effective dose equivalent (TEDE) to the maximally exposed individual (MEI) from the 241-UX-302A emission unit is  $2.73\text{E-}04$  millirem per year. The abated emissions are estimated to be  $2.73\text{E-}06$  millirem per year. The estimated TEDE to the MEI from the 241-AZ-154 is  $4.76\text{E-}12$  millirem per year with abated emissions estimated at  $4.76\text{E-}14$  millirem per year. The estimated TEDE to the MEI from the 241-U-301B emission unit is  $2.26\text{E-}11$  millirem per year with abated emissions estimated at  $2.26\text{E-}13$  millirem per year. The estimated TEDE to the MEI from the 241-S-302 emission unit is  $1.88\text{E-}01$  millirem per year with abated emissions estimated at  $1.88\text{E-}03$  millirem per year.

The installation and operation of breather filters on fugitive emission sources establishes registered point sources. No actual increase in radiological emissions will occur with utilization of breather filters.

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**LIST OF TERMS**

**ABBREVIATIONS AND ACRONYMS**

ALARA	as low as reasonably achievable
ALARACT	As Low As Reasonably Achievable Control Technology
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
BARCT	best available radionuclide control technology
CFR	<i>Code of Federal Regulations</i>
DST	double-shell tank
GEMS	generic effluent monitoring system
HEPA	high-efficiency particulate air
IMUST	insignificant miscellaneous underground storage tanks
ISVS	in-situ vapor sampling
LFL	lower flammability limit
MEI	maximally exposed individual
MPR	maximum public receptor
NOC	notice of construction
PCM	periodic confirmatory measurement
PC-SACS	surveillance analysis computer system
SEPA	State Environmental Policy Act of 1971
SST	single-shell tank
TCR	Tank Characterization Report
TEDE	total effective dose equivalent
TWINS	Tank Waste Information Network System
VSS	vapor sampling system
WAC	<i>Washington Administrative Code</i>
WDOH	Washington State Department of Health

**UNITS**

cfm	cubic feet per minute
Ci	curie
mrem/yr	millirem per year



**Radioactive Air Emissions Notice of Construction Application for Installation and Operation of  
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**Table 1. Metric Conversion Chart**

<b>Into metric units</b>			<b>Out of metric units</b>		
<b>If you know</b>	<b>Multiply by</b>	<b>To get</b>	<b>If you know</b>	<b>Multiply by</b>	<b>To get</b>
<b>Length</b>			<b>Length</b>		
inches	25.40	millimeters	millimeters	0.0393	inches
inches	2.54	centimeters	centimeters	0.393	inches
feet	0.3048	meters	meters	3.2808	feet
yards	0.914	meters	meters	1.09	yards
miles	1.609	kilometers	kilometers	0.62	miles
<b>Area</b>			<b>Area</b>		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.092	square meters	square meters	10.7639	square feet
square yards	0.836	square meters	square meters	1.20	square yards
square miles	2.59	square kilometers	square kilometers	0.39	square miles
acres	0.404	hectares	hectares	2.471	acres
<b>Mass (weight)</b>			<b>Mass (weight)</b>		
ounces	28.35	grams	grams	0.0352	ounces
pounds	0.453	kilograms	kilograms	2.2046	pounds
short ton	0.907	metric ton	metric ton	1.10	short ton
<b>Volume</b>			<b>Volume</b>		
fluid ounces	29.57	milliliters	milliliters	0.03	fluid ounces
quarts	0.95	liters	liters	1.057	quarts
gallons	3.79	liters	liters	0.26	gallons
cubic feet	0.03	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.76456	cubic meters	cubic meters	1.308	cubic yards
<b>Temperature</b>			<b>Temperature</b>		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
<b>Force</b>			<b>Force</b>		
pounds per square inch	6.895	kilopascals	kilopascals	$1.4504 \times 10^{-4}$	pounds per square inch

Source: Lindeburg, M.R., PE., Second Ed., 1990, *Engineering Unit Conversions*, Professional Publications, Inc., Belmont, California.

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**1.0 FACILITY NAME AND LOCATION**

*Regulatory Citation: "Name and address of the facility, location (latitude and longitude) of the emission unit(s)."*

The 241-U, 241-S, and 241-AZ Tank Farms are located in the U.S. Department of Energy Hanford Site, Richland, Washington. This Tank Farm Facility is managed and operated by CH2M HILL Hanford Group, Inc., for the Department of Energy, Office of River Protection (ORP) under contract DE-AC06-99RL-14047. The address is as follows:

U.S. Department of Energy, Office of River Protection  
Hanford Site  
200 West Area Tank Farms  
Richland, Washington 99352

The U Tank Farm is located in the 200 West Area of the Hanford Site. The Geodetic coordinates are:

241-U:	Latitude:	46 deg.N 32 min. 46 sec.
	Longitude:	119 deg.W 37 min. 42 sec.

The S Tank Farm is located in the 200 West Area of the Hanford Site. The Geodetic coordinates are:

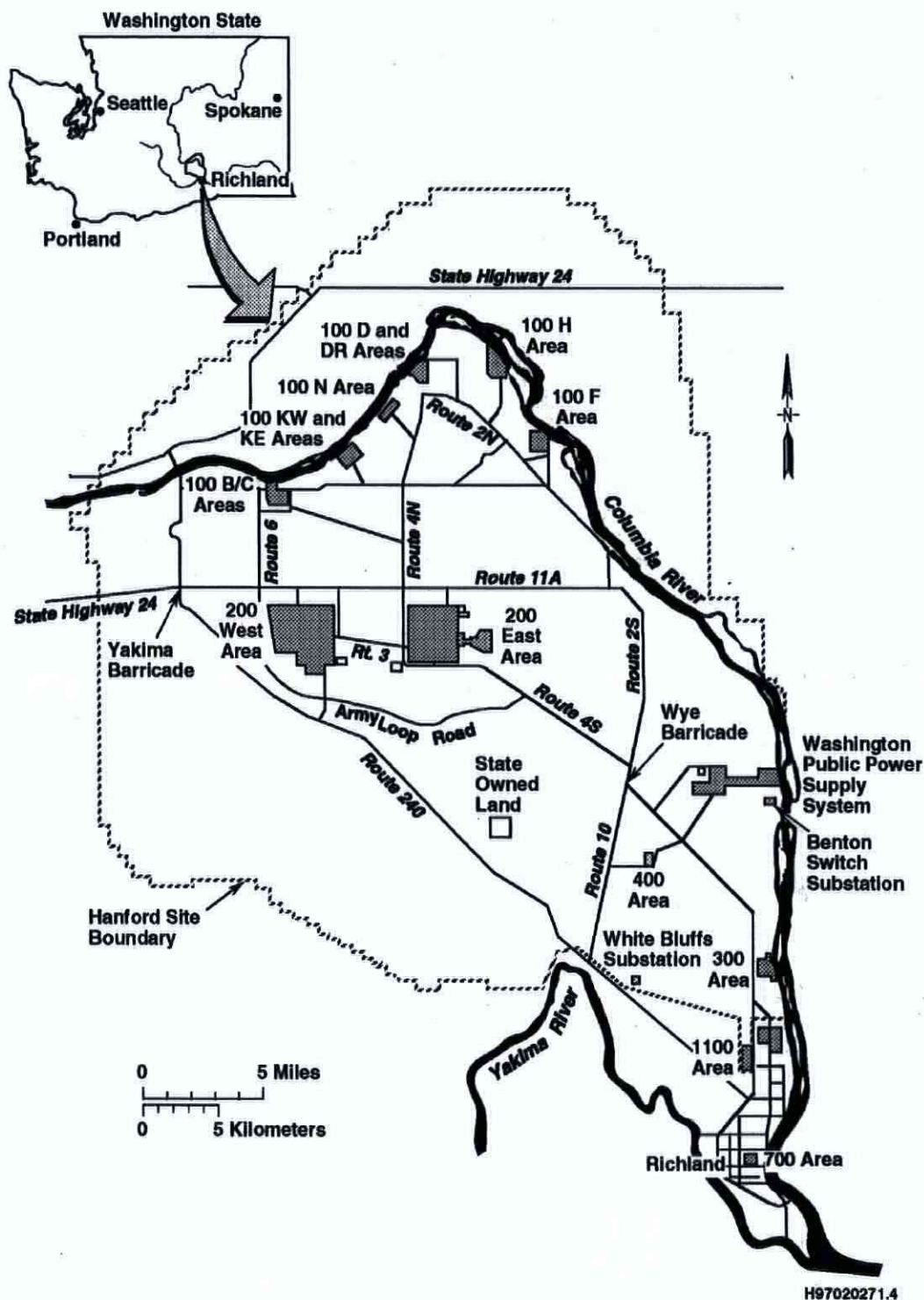
241-S:	Latitude:	46 deg.N 33 min. 20 sec.
	Longitude:	119 deg.W 37 min. 44 sec.

The AZ Tank Farm is located in the 200 East Area of the Hanford Site. The Geodetic coordinates are:

241-AZ:	Latitude:	46 deg.N 33 min. 18 sec.
	Longitude:	119 deg. W 31 min. 01 sec.

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Figure 1. The Hanford Site





Radioactive Air Emissions Notice of Construction Application for Installation and Operation of  
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## 2.0 RESPONSIBLE MANAGER

*Regulatory Citation: "Name, title, address, and phone number of responsible manager."*

The responsible facility manager is:

Shirley J. Olinger, Manager  
U.S. Department of Energy, Office of River Protection  
P.O. Box 550  
Richland, Washington 99352  
(509) 372-3062

## 3.0 PROPOSED ACTION

*Regulatory Citation: "Identify the type of proposed action for which this application is submitted:*

- a. Construction of new emission unit(s);*
- b. Modification of existing emission unit(s); identify whether this is a significant modification – significant means the potential-to-emit airborne radioactivity at a rate that could increase the TEDE to the MEI by at least 1.0 mrem/yr as a result of the proposed modification;*
- c. Modification of existing unit(s), unregistered."*

This application is submitted in accordance with WAC 246-247-060(1)(a) for modification of existing unregistered emission units. It is not significant as defined by WAC 246-247-030(25).

The action proposed is the installation of a passive breather filter on the 241-UX-302A, 241-AZ-154, 241-U-301B and 241-S-302 catch tanks. The filter utilized will be replaced and disposed of on an annual basis, eliminating the need for annual aerosol testing.

Former emissions from these catch tanks were diffuse and fugitive. The act of isolating and sealing the catch tanks and installing breather filters will channel any residual emissions to single locations creating point sources. No increase in the TEDE to the MEI is expected as a result of this modification.

## 4.0 STATE ENVIRONMENTAL POLICY ACT OF 1971

*Regulatory Citation: "If the project is subject to the requirements of the State Environmental Policy Act (SEPA) contained in chapter 197-11 WAC, provide the name of the lead agency, lead agency contact person, and their phone number."*



## Radioactive Air Emissions Notice of Construction Application for Installation and Operation of Breather Filters on Miscellaneous Tanks

The proposed action is categorically exempt from the requirements of SEPA under WAC 197-11-845, "Department of Social and Health Services."

### 5.0 CHEMICAL AND PHYSICAL PROCESSES

*Regulatory Citation: "Describe the chemical and physical processes upstream of the emission unit(s)."*

The 241-UX-302A catch tank is a 17,760 gallon capacity catch tank designed to receive overflow from Diversion Box 241-UX-154. Use of this catch tank has been discontinued and was isolated in June of 2005. HNF-EP-0182, Rev. 210, 2005, *Waste Tank Summary Report for Month Ending September 30, 2005* indicates that approximately 1,736 gallons of waste remain in this tank. With the breather filter installed, any radioactive particulates that may be emitted as a consequence of barometric pressure changes will be minimized.

The 241-AZ-154 catch tank is an 869 gallon capacity catch tank designed to receive condensate from the 241-AZ and 241 AY double shell tank heating coils. The steam coils have since been blanked off and use of the catch tank discontinued in 1992. Currently the Surveillance Analysis Computer System (PC-SACS) data indicates this tank is empty. Periodically water intrusion is seen in this tank from rain and snow.

The 241-U-301B catch tank is a 36,000 gallon capacity catch tank designed to support waste transfers from 244-TX via 241-U-151 and 241-U-152. Waste was last transferred out of U-301B by truck in December of 2003. The transfer route was taken out of service in June of 2005. Currently PCSACS data indicates that 1,467 gallons of waste remain in this tank.

The 241-S-302 catch tank is a 17,700 gallon capacity catch tank designed to receive leakage, spills, line flushes and drainage associated with support waste transfers through Diversion Box 240-S-151. Since isolation in 1987 the tank has received intrusion of snow melt and rainwater to it's present level.

The installation of breather filters is intended to minimize any radioactive particulates that may be emitted as a consequence of barometric pressure changes.

### 6.0 EXISTING AND PROPOSED ABATEMENT TECHNOLOGY

*Regulatory Citation: "Describe the existing and proposed (as applicable) abatement technology. Describe the basis for the use of the proposed system. Include expected efficiency of each control device, and the annual average volumetric flow rate(s) in meters/sec for the emission unit(s)."*

The proposed abatement technology is the installation of a passive breather filter. In this configuration the tank is expected to "breathe" at the rate of approximately 0.007 cfm with a flow rate of less than 1 cfm. The breather filter will be a radial high-efficiency particulate air (HEPA) filter with a manufacturer rated removal efficiency of 99.97% and a rated capacity of 40 cfm.

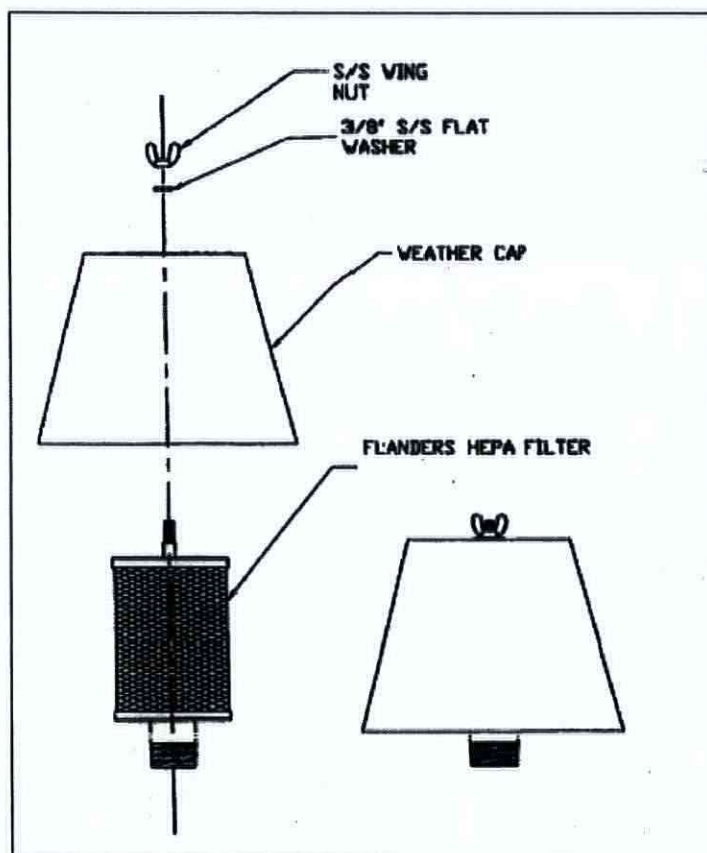
## Radioactive Air Emissions Notice of Construction Application for Installation and Operation of Breather Filters on Miscellaneous Tanks

During installation of this breather filter, controls established in As Low As Reasonably Achievable Control Technology (ALARACT) 1, "Demonstration for Riser Preparation/Opening," and ALARACT 16, "Demonstration for Work on Potentially Contamination Ventilation System Components", will be used where applicable.

### 7.0 APPLICABLE CONTROL TECHNOLOGY DRAWINGS

*Regulatory Citation: "Provide conceptual drawings showing all applicable control technology components from the point of entry of radionuclides into the vapor space to release to the environment."*

**Figure 2. Radial Breather Filter**





Radioactive Air Emissions Notice of Construction Application for Installation and Operation of  
Breather Filters on Miscellaneous Tanks

## 8.0 RADIONUCLIDES OF CONCERN – POTENTIAL EMISSIONS

*Regulatory Citation: "Identify each radionuclide that could contribute greater than ten percent of the potential-to-emit TEDE to the MEI."*

Sampling indicates that Sr-90 contributes greater than ten percent of the potential to-emit TEDE to the MEI from operation of a breather filter on catch tank 241-UX-302A. Radionuclides Pu-239/240 and Cs-137 combined contribute approximately 3%. This is substantiated by direct application of the CAP-88 dose conversion factors, discussed in section 14, to the Inventory values listed in Table 2. Multiplying the curies of each radionuclide by the on-site MPR Cap-88 Unit Dose factors indicates that Sr-90 would contribute 97% of the dose to the MEI.

Similarly, sampling indicates that Sr-90 contributes 74% and Pu-239/240 contributes 10% of the potential-to-emit TEDE to the MEI from operation of a breather filter on catch tank 241-S-302. The remaining radionuclides each contribute less than 10% of the total.

The contributions from 241-AZ-154 and 241-U-301B represent such a small percentage of the total that they do not affect these ratios.

## 9.0 EFFLUENT MONITORING SYSTEM FOR THE PROPOSED CONTROL SYSTEM

*Regulatory Citation: "Describe the effluent monitoring system for the proposed control system. Describe each piece of monitoring equipment and its monitoring capability, including detection limits, for each radionuclide that could contribute greater than ten percent of the potential-to-emit TEDE to the MEI, or greater than 0.1 mrem/yr potential-to-emit TEDE to the MEI, or greater than twenty-five percent of the TEDE to the MEI, after controls. Describe the method with detail sufficient to demonstrate compliance with the applicable requirements."*

Once installed, smears will be taken in accordance with the Air Operating Permit. Monitoring during the disconnecting of the old ventilation system and the mounting of the new HEPA breather filter will be in accordance with ALARACT 1, "Demonstration for Riser Preparation/Opening," and ALARACT 16, "Tank Farm ALARACT Demonstration For Work On Potentially Contaminated Ventilation System Components."

The sludge remaining in 241-S-302 has a potential-to-emit TEDE to the MEI of greater than 0.1 mrem/yr. Sr-90 and Pu-239/240 each contribute greater than 10% of the total, but only Sr-90 contributes greater than 25% after controls. Breather filters are not equipped with monitoring systems; therefore, either an Assay or Non-destructive Assay will be performed annually, upon removal of the breather filter as an alternative to monitoring.

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## 10.0 RADIONUCLIDE ANNUAL POSSESSION QUANTITY

*Regulatory Citation: "Indicate the annual possession quantity for each radionuclide."*

The annual possession quantity for Tank 241-UX-302A is listed in Table 2. The inventory data was drawn from TWINS, Best Basis/TCR, Tank Inventory, dated 12/01/2005. The inventory was derived from results of samples drawn on 06/04/02 and reported in TWINS.

HNF-EP-0182, Rev. 210, indicates that 1,736 gallons of waste are left in this tank.

**Table 2. Tank 241-UX-302A Inventory**

<b>Tank 241-UX-302A Inventory</b>		
<b>Radionuclide</b>	<b>Inventory</b>	
	<b>APQ (curies)</b>	<b>Curies per Gallon</b>
90Sr	3.02E+00	1.74E-03
137Cs	3.14E-01	1.81E-04
239/240Pu	8.48E-05	4.88E-08

The annual possession quantity for Tank 241-AZ-154 is listed in Table 3. No sample data was available for the 241-AZ-154 catch tank, per se, as no activity has taken place since 1991. However, the concentration of radionuclides found in 241-AZ-151 can be assumed to provide a conservative representation of the concentrations in 241-AZ-154, since both received condensate from AY/AZ tank systems. Gross alpha and gross beta Cs-137 results were drawn from analytical results of a sample taken from 241-AZ-151 in April of 2005 (WSCF Analytical Results Report #20050793) to estimate concentrations and annual possession quantities in 241 AZ-154. Am-241 was assumed to represent alpha and Sr-90 was assumed to represent beta.

**Table 3. Tank 241-AZ-154 Inventory**

<b>Tank 241-AZ-154 Inventory</b>		
<b>Radionuclide</b>	<b>Inventory</b>	
	<b>APQ (curies)</b>	<b>Curies per Gallon</b>
Alpha (241Am)	1.99E-11	1.79E-13
Beta (90Sr)	1.32E-08	5.30E-10
137Cs	1.27E-08	5.07E-10

The annual possession quantity for Tank 241-U-301B is listed in Table 4. The inventory data sources were drawn from analytical results of samples drawn from the tank in August of 2002.



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**Table 4. Tank 241-U-301B Inventory**

Tank 241-U-301B Inventory		
Radionuclide	Inventory	
	APQ (curies)	Curies per Gallon
241Am	1.11E-09	7.57E-13
239/240Pu	1.39E-09	9.46E-13
90Sr	3.33E-09	2.27E-12
234U	3.28E-10	2.23E-13
235U	1.28E-10	8.71E-14
65Zn	7.77E-08	5.30E-11

The annual possession quantity for Tank 241-S-302 is listed in Table 5. The inventory data source for the sludge is TWINS, Best Basis/TCR, Tank Inventory dated 7/01/2008. The inventory was derived from results of samples drawn on 11/04/07. The data source for the liquid is HNF-SD-WM-DP-294, Sept. 10, 2007, *Tank 240-S-302, Grab Samples, 302S-97-1, 302S-97-2 and 302S-97-3 Analytical Results for the Final Report*. A November 6, 2007 Zip Cord measurement indicates that this tank contains approximately 8,000 gallons of waste. An inches-to-gallons conversion was performed in accordance with RPP-11866, Revision 0, 2002, *Technical Basis for the Operating Specifications for Miscellaneous Facilities*. Approximately 1,073 gallons of this waste will remain in the tank.

**Table 5. Tank 241-S-302 Inventory**

Radionuclide	Maximum Concentration		APQ Ci
	Sludge	Liquid	
	Ci/gal	Ci/gal	
241Am	1.53E-03	2.21E-08	1.64E+00
125Sb	1.12E-03		1.21E+00
144Cm	1.51E-03		1.62E+00
134Cs	3.87E-04		4.16E-01
137Cs	3.93E-02	8.74E-05	4.28E+01
60Co	3.62E-04	1.05E-07	3.90E-01
243/244Cu	1.83E-04		1.96E-01
152Eu	1.65E-03		1.77E+00
154Eu	1.19E-03		1.28E+00
155Eu	7.82E-04		8.39E-01
94Ni	4.32E-04		4.64E-01
239/240Pu	2.84E-03	1.13E-07	3.05E+00
226Ra	5.96E-03		6.39E+00
106Ru/Rh	7.71E-03		8.27E+00
89/90Sr	1.48E+00	1.62E-05	1.58E+03

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## 11.0 PHYSICAL FORM OF EACH RADIONUCLIDE IN THE INVENTORY

*Regulatory Citation: "Indicate the physical form of each radionuclide in inventory: Solid, particulate solids, liquid, or gas."*

Each radionuclide in the inventory listed in Section 10.0 is contained in the tank waste, which consists of sludge and liquids.

## 12.0 RELEASE FORM OF EACH RADIONUCLIDE IN THE INVENTORY

*Regulatory Citation: "Indicate the release form of each radionuclide in inventory: Particulate solids, vapor, or gas. Give the chemical form and ICRP 30 solubility class, if known."*

The radionuclides in the inventory listed in Section 10.0 are all assumed to be released as particulates.

## 13.0 RELEASE RATES

*Regulatory Citation:*

*"a. New emission unit(s): Give predicted release rates without any emission control equipment (the potential-to-emit) and with the proposed control equipment using the efficiencies described in subsection 6 of this section.*

*b. Modified emission unit(s): Give predicted release rates without any emissions control equipment (the potential-to-emit) and with the existing and proposed control equipment using the efficiencies described in subsection 6 of this section. Provide the latest year's emission data or emissions estimates.*

*In all cases, indicate whether the emission unit is operating in a batch or continuous mode."*

Total emissions from the entire Hanford Site during calendar year 2007 were reported as 0.14 mrem in DOE/RL-2008-03, Rev.0, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2007*.

Release rates are shown in Tables 6 through 8. Releases are expected to be continuous. The values were taken directly from sampling data reported in the TWINS best basis inventory as identified in section 10.0



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**Table 6. Tank 241-UX-302A Release Rates**

Radio-nuclide	Maximum Concentration		APQ	Release Fraction	CAP88-PC		Unabated TEDE to MEI		Abated TEDE to MEI		
	uCi/mL	Ci/gal			Ci	off-site	on-site	off-site	on-site	off-site	on-site
						mrem/Ci	mrem/Ci	mrem/yr	mrem/yr	mrem/yr	mrem/yr
Cs-137	4.78E-02	1.81E-04	3.14E-01	1.00E-03	1.90E-01	3.10E-01	5.97E-05	9.74E-05	5.97E-07	9.74E-07	
Pu-239/240	1.29E-05	4.88E-08	8.48E-05	1.00E-03	6.40E+00	1.10E+01	5.42E-07	9.32E-07	5.42E-09	9.32E-09	
Sr-90	4.60E-01	1.74E-03	3.02E+00	1.00E-03	8.80E-02	1.10E-02	2.66E-04	3.32E-05	2.66E-06	3.32E-07	
							3.26E-04	1.32E-04	3.26E-06	1.32E-06	

**Table 7. Tank 241-AZ-154 Release Rates**

Radio-nuclide	Maximum Concentration		APQ	Release Fraction	CAP88-PC		Unabated TEDE to MEI		Abated TEDE to MEI		
	uCi/mL	Ci/gal			Ci	off-site	on-site	off-site	on-site	off-site	on-site
						mrem/Ci	mrem/Ci	mrem/yr	mrem/yr	mrem/yr	mrem/yr
Alpha (Am-241)	2.10E-10	7.95E-13	1.99E-11	1.00E-03	1.30E+01	1.50E+01	2.58E-13	2.98E-13	2.58E-15	2.98E-15	
Beta (Sr-90)	1.40E-07	5.30E-10	1.32E-08	1.00E-03	1.10E-01	9.50E-03	1.46E-12	1.26E-13	1.46E-14	1.26E-15	
Cs-137	1.34E-07	5.07E-10	1.27E-08	1.00E-03	2.40E-01	2.70E-01	3.04E-12	3.42E-12	3.04E-14	3.42E-14	
							4.76E-12	3.85E-12	4.76E-14	3.85E-14	

**Table 8. Tank 241-U-301B Release Rates**

Radio-nuclide	Concentration		APQ	Release Fraction	CAP88-PC		Unabated TEDE to MEI		Abated TEDE to MEI		
	uCi/mL	Ci/gal			Ci	off-site	on-site	off-site	on-site	off-site	on-site
						mrem/Ci	mrem/Ci	mrem/yr	mrem/yr	mrem/yr	mrem/yr
Am-241	2.00E-10	7.57E-13	1.11E-09	1.00E-03	9.80E+00	1.70E+01	1.09E-11	1.89E-11	1.09E-13	1.89E-13	
Pu-239/240	2.50E-10	9.46E-13	1.39E-09	1.00E-03	6.40E+00	1.10E+01	8.88E-12	1.53E-11	8.88E-14	1.53E-13	
Sr-90	6.00E-10	2.27E-12	3.33E-09	1.00E-03	8.80E-02	1.10E-02	2.93E-13	3.66E-14	2.93E-15	3.66E-16	
U-234	5.90E-11	2.23E-13	3.28E-10	1.00E-03	2.40E+00	4.20E+00	7.86E-13	1.38E-12	7.86E-15	1.38E-14	
U-235	2.30E-11	8.71E-14	1.28E-10	1.00E-03	2.30E+00	4.00E+00	2.94E-13	5.11E-13	2.94E-15	5.11E-15	
Zn-65	1.40E-08	5.30E-11	7.77E-08	1.00E-03	1.90E-02	1.30E-02	1.48E-12	1.01E-12	1.48E-14	1.01E-14	
							2.26E-11	3.71E-11	2.26E-13	3.71E-13	



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**Table 9. Tank 241-S-302 Release Rates**

Radio-nuclide	Maximum Concentration		APQ	Release Fraction	CAP88-PC		Unabated TEDE to MEI		Abated TEDE to MEI	
	Sludge	Liquid			off-site	on-site	off-site	on-site	off-site	on-site
	Ci/gal	Ci/gal			mrem/Ci	mrem/Ci	mrem/yr	mrem/yr	mrem/yr	mrem/yr
241Am	1.53E-03	2.21E-08	1.64E+00	1.00E-03	9.80E+00	1.70E+01	1.60E-02	2.78E-02	1.60E-04	2.78E-04
125Sb	1.12E-03		1.21E+00	1.00E-03	2.10E-02	3.70E-02	2.53E-05	4.47E-05	2.53E-07	4.47E-07
144Cm	1.51E-03		1.62E+00	1.00E-03	1.00E-02	1.30E-02	1.62E-05	2.11E-05	1.62E-07	2.11E-07
134Cs	3.87E-04		4.16E-01	1.00E-03	7.80E-02	1.00E-01	3.24E-05	4.16E-05	3.24E-07	4.16E-07
137Cs	3.93E-02	8.74E-05	4.28E+01	1.00E-03	1.90E-01	3.10E-01	8.13E-03	1.33E-02	8.13E-05	1.33E-04
60Co	3.62E-04	1.05E-07	3.90E-01	1.00E-03	1.9E-01	3.40E-01	7.40E-05	1.32E-04	7.40E-07	1.32E-06
243/244Cu	1.83E-04		1.96E-01	1.00E-03	6.60E+00	1.20E+01	1.29E-03	2.35E-03	1.29E-05	2.35E-05
152Eu	1.65E-03		1.77E+00	1.00E-03	1.90E-01	3.40E-01	3.37E-04	6.03E-04	3.37E-06	6.03E-06
154Eu	1.19E-03		1.28E+00	1.00E-03	1.50E-01	2.80E-01	1.92E-04	3.59E-04	1.92E-06	3.59E-06
155Eu	7.82E-04		8.39E-01	1.00E-03	6.30E-03	1.10E-02	5.29E-06	9.23E-06	5.29E-08	9.23E-08
94Ni	4.32E-04		4.64E-01	1.00E-03	6.30E-01	1.10E+00	2.92E-04	5.10E-04	2.92E-06	5.10E-06
239/240Pu	2.84E-03	1.13E-07	3.05E+00	1.00E-03	6.40E+00	1.10E+01	1.95E-02	3.35E-02	1.95E-04	3.35E-04
226Ra	5.96E-03		6.39E+00	1.00E-03	3.60E-01	2.90E-01	2.30E-03	1.85E-03	2.30E-05	1.85E-05
106Ru/Rh	7.71E-03		8.27E+00	1.00E-03	1.60E-02	2.20E-02	1.32E-04	1.82E-04	1.32E-06	1.82E-06
89/90Sr	1.48E+00	1.62E-05	1.58E+03	1.00E-03	8.80E-02	1.10E-02	1.39E-01	1.74E-02	1.39E-03	1.74E-04
							<b>1.88E-01</b>	9.80E-02	<b>1.88E-03</b>	9.80E-04

## 14.0 DISTANCES AND DIRECTION OF THE MAXIMALLY EXPOSED INDIVIDUAL

*Regulatory Citation: "Identify the MEI by distances and direction from the emission unit(s). The MEI is determined by considering distance, windrose data, presence of vegetable gardens, and meat or milk producing animals at unrestricted areas surrounding the emission unit."*

The MEI is determined using CAP-88 dispersion factors, which are derived for use on the Hanford Site and published in HNF-3602, Revision 1, *Calculating Potential-to-Emit Releases and Doses for FEMPs and NOCs*. Values used for the 241-AZ-154 catch tank were taken from Table 4-9, for 200 East Area with effective release height < 40 m. Values used for the 241-UX-302A, 241-U-301B and 241-S-302 catch tanks were taken from Table 4-10, for 200 West Area with effective release height < 40 m. Unit Dose factors from both the off-site MPR and on-site MPR were examined. The off-site MPR Unit Dose factors were used to perform the final calculations as they were determined to return the highest values. In this case, according to HNF-3602, Table 4-2, the MEI location is 20,200 meters ESE of the East emission zone and 22,000 meters ES of the West emission zone. These locations are at Ringold and Horn Rapids respectively.



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**15.0 TOTAL EFFECTIVE DOSE EQUIVALENT TO THE MAXIMALLY  
EXPOSED INDIVIDUAL**

*Regulatory Citation: "Calculate the TEDE to the MEI using an approved procedure (see WAC 246-247-085). For each radionuclide identified in subsection 8 of this section, determine the TEDE to the MEI for existing and proposed emission controls, and without any emission controls (the potential-to-emit) using release rates from subsection 13 of this section. Provide all input data used in the calculations."*

The unabated and abated TEDE from each catch tank is presented in Tables 6 through 9 above. The unabated emissions were derived from sampling results for miscellaneous tanks reported in TWINS. The highest sample results for each radionuclide that was found to be at or above detection levels were used to determine the inventory. A release fraction of 1.0E-03 and CAP-88-PC dispersion factors were applied to the inventory to estimate the TEDE.

Abated emissions are derived by applying an adjustment factor of 0.01 to the TEDE as specified in 40 CFR 61, Appendix D.

$$2.73\text{E-}04 \text{ mrem/yr} \times 0.01 = 2.73\text{E-}06 \text{ mrem/yr}$$

This decontamination factor was selected, in lieu of the efficiency of the HEPA filters, as a means of maintaining conservatism when estimating effects of passive breathing equipment.

**16.0 COST FACTORS/BEST AVAILABLE RADIONUCLIDE CONTROL  
TECHNOLOGY OR AS LOW AS REASONABLY ACHIEVABLE  
DEMONSTRATION**

*Regulatory Citation: "Provide cost factors for construction, operating, and maintenance of the proposed control technology components and system, if a BARCT or ALARACT demonstration is not submitted with the NOC."*

Pursuant to WAC 246-247-110, Appendix A(16), cost factors for construction, operation, and maintenance of proposed technology requirements are not required, as the WDOH has provided guidance that HEPA filters generally are the best available radionuclide control technology (BARCT) for particulate emissions (AIR 92-107). Because the radionuclides of concern are particulates, it is proposed that the HEPA filter controls described in Section 6.0 be accepted as BARCT. Compliance with the substantive BARCT technology standards is described in Section 18.0.

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## 17.0 FACILITY PROCESS ESTIMATED LIFETIME

*Regulatory Citation: "Provide an estimate of the lifetime for the facility process with the emission rates provided in this application."*

Use of the breather filters will continue for the duration of the life of the facility. Current planning for this tank indicates a lifetime of approximately 20 years.

## 18.0 CONTROL TECHNOLOGY STANDARDS

*Regulatory Citation: "Indicate which of the following control technology standards have been considered and will be complied with in the design and operation of the emission unit(s) described in this application."*

In the passive breathing mode, most miscellaneous tanks will not have the potential to emit greater than 0.1 mrem/yr TEDE to the MEI. Therefore, the design of the HEPA breather filter must meet, as applicable and to the extent justified by a cost/benefit evaluation, the technology standards listed under WAC 246-247-110(18). For those tanks whose potential emissions may exceed 0.1 mrem/yr the design must meet the technology standards listed under WAC 246-247-120. Table 10 summarizes the compliance of emissions control equipment listed with technology standards.

**Table 10. Emissions Control Equipment Standards Compliance for Breather Filters**

Standard	Does design comply?	Notes
ASME/ANSI AG-1 ASME/ANSI N509 ASME/ANSI N510	Yes N/A N/A	Filters and housing design meet applicable requirements of ASME AG-1. Installed filters are not testable per ANSI N510. AG-1 compliance matrix presented in Appendix A identifies variations and equivalencies.
ANSI/ASME NQA-1, -2	Yes	Current version of QA program is RPP-MP-600.
ANSI N13.1 ANSI N42.18	Yes N/A	Confirmatory measurements will consist of smears on the filter. For units with PTE>0.1 mrem/yr an Assay or NDA will be performed annually.
40 CFR 60, Appendix A Test Methods: 1, 1A, 2, 2A, 2C, 2D, 4	N/A	Because flow rates vary due to barometric breathing, flow measurements by these methods do not apply. Confirmatory measurements will consist of smears on the filter and/or Assays or NDAs.
40 CFR 60, Appendix A Test Methods: 5, 17	N/A	These methods are for sampling system designs. Periodic confirmatory measurements will be taken via smears or for units with PTE>0.1 mrem/yr an Assay or NDA will be performed annually, in lieu of a sampling system.
ERDA 76-21	Yes	General standard
ACGIH 1988	Yes	General standard



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**19.0 REFERENCES**

- 40 CFR 60, "Standards for Performance of New Stationary Sources," *Code of Federal Regulations*, as amended.
- 40 CFR 61, "National Emission Standards for Hazardous Air Pollutant." *Code of Federal Regulations*, as amended.
- AIR 92-107, October 5, 1992, Letter from Allen W. Conklin, Washington Department of Health to James D. Bauer, Department of Energy, Richland, Washington.
- ANSI/ASME AG-1, 2003, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers, New York, New York.
- ANSI/ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, American Society of Mechanical Engineers, New York, New York.
- ANSI/HPS N13.1, 1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from Stacks and Ducts of Nuclear Facilities*, American National Standards Institute, New York, New York.
- ANSI N13.1, 1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, American National Standards Institute, New York, New York.
- ANSI N509, *Nuclear Power Plant Air Cleaning Units and Components*, American National Standards Institute, New York, New York.
- ANSI N510, *Testing of Nuclear Air Treatment Systems*, American National Standards Institute, New York, New York.
- DOE/RL-2006-29, Revision 0, 2006, *Calculating Potential-to-Emit Radiological Releases and Doses*, United States Department of Energy, Richland, Washington.
- DOE/RL-2008-03, Revision 0, 2008, *Radionuclide Air Emissions Report for the Hanford site, Calendar Year 2007*
- HNF-EP-0182-210, 2005, *Waste Tank Summary Report for Month Ending September 30, 2005*, CH2M HILL Hanford Group, Inc., Richland, Washington.
- HNF-EP-0182-210, 2005, *Waste Tank Summary Report for Month Ending June 30, 2008*, CH2M HILL Hanford Group, Inc., Richland, Washington.
- HNF-SD-WM-DP-294 Revision 0A, 1997, *Tank 240-S-302, Grab Samples, 302S-97-1, 302S-97-2 and 302S-97-3 Analytical Results for the Final Report*, CH2M HILL Hanford Group, Inc., Richland, Washington.

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HNF-0528, Revision 5, *National Emission Standards for Hazardous Air Pollutants (NESHAP) Quality Assurance Project Plan for Radioactive Airborne Emissions*, Fluor Hanford Group, Inc., Richland Washington

HNF-4327, Revision 3, 2005, *Control of Airborne Radioactive Emissions for Frequently Performed TWRS Work Activities (ALARACT Demonstrations)*, CH2M HILL Hanford Group, Inc., Richland, Washington.

Lindeburg, M.R., PE., Second Ed., 1990, *Engineering Unit Conversions*, Professional Publications, Inc., Belmont, California.

RPP-11866, Revision 0, 2002, *Technical Basis for the Operating Specifications for Miscellaneous Facilities*. CH2M HILL Hanford Group, Inc., Richland, Washington.

WAC 197-11-845, *State Environmental Policy Act*, "SEPA Rules, Department of Social and Health Services," *Washington Administrative Code*, as amended.

WAC 246-247, "Radiation Protection – Air Emissions," *Washington Administrative Code*, as amended.

WHC-SD-WM-CN-116, Rev. 0-A, 1997, L.A. Stauffer, *Calculation Note: Hydrogen Generation Rates at Steady-State Flammable Gas Concentrations for Single Shell Tanks*

WSCF Analytical Results Report #20050793, April 2005



## **APPENDIX A**

### **AG-1 COMPLIANCE MATRIX FOR FLANDERS FILTER MODEL 0-007-1-12-RF-NU-00-E3-Z04059**

**Based on ASME AG-1 2003 Edition**

<b>Status Key:</b>	<b>CC:</b>	<b>Complies with ASME AG-1 as stated in the code</b>
	<b>C%:</b>	<b>Complies with ASME AG-1 based on applicability</b>
	<b>DR</b>	<b>Does not comply, deviation requested</b>
	<b>NA</b>	<b>Not applicable</b>

## A.1 SECTION AA (Common Articles)

This section is general and applies as stated to applicable ventilation components. More details of these general requirements as applicable to specific components can be found in the ASME AG-1 code under the each components section. The requirements in this general section have been grouped and summarized as applicable to use of this 40 cfm radial HEPA filter ventilation system on the Hanford single-shell waste tanks (SSTs).

Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators Flanders 40 cfm Filter
	COMMON ARTICLES	AA		
	INTRODUCTION	AA-1100	INTRODUCTION	
1	SCOPE (AA-1100) – Purpose; Applicability; Definitions and Terms	AA-1100 To AA-1130	No requirements stated.	NA
	REFERENCED DOCUMENTS	AA-2000	REFERENCED DOCUMENTS	
2	Referenced Documents		No requirements stated.	NA
	MATERIALS	AA-3000	MATERIALS	
3	Materials	AA-3000	Materials requirements specified in applicable component section of AG-1.	NA
	STRUCTURAL DESIGN	AA-4000	STRUCTURAL DESIGN	
4	SCOPE (AA-4100) – Environmental Qualification DESIGN (AA-4200) – Loads Criteria; Stress Criteria, Deflection Criteria; Other Criteria	AA-4100 To AA-4243	ASME AG-1 loads associated with nuclear power plant accident scenarios are not applicable to waste tank ventilation systems, however, the structural design of the pressure boundary components and associated supports meet the applicable Hanford design loads in CH2M HILL's Standard TFC-ENG-STD-06 "Design Loads For Tank Farm Facilities". This standard (REV B-3) does not require seismic loads to be considered for this type of temporary general service equipment used in single-shell tank (SST) retrieval and closure; classified in the standard as performance category PC-1M.  Except for the above exemption, the HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.  Standard industrial and manufacturers' standards for loads, stresses, deflections, and verification are adequate. Service limits from AG-1 were not assigned; however, AG-1 Service Level A (from Table AA-4212) is comparable to this application.  Waste tank ventilation systems have no unusual loading or design geometry that requires application of the rigorous structural analysis of ASME AG-1. Manufacturers' analysis procedures are acceptable.	C%



Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators	
				Flanders 40 cfm Filter	
5	DESIGN OF EQUIPMENT SYSTEMS AND THEIR SUPPORTING ELEMENTS (AA-4300) – General Requirements; Design Verification of Plate - and Shell-Type Components and Their supporting Elements; Design Verification of Linear-Type Systems by Analysis, Functionability Requirements	AA-4300 To AA-4342	<p>The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.</p> <p>The waste tank ventilation system has no unusual loading or design geometry that requires application of the rigorous structural analysis of ASME AG-1. Manufacturers' analysis procedures are acceptable.</p> <p>Additional function verification in section AA-4320 is not required. The stress limits applied to these components assure that the waste tank ventilation system will be able to perform its required emission control function by maintaining structural integrity under normal operating conditions.</p> <p>Seismic testing is not required (See AA-4200). The seismic testing of this section is intended to verify satisfactory operability of safety systems at nuclear power plants during design basis seismic events. The control of emissions within regulatory standards require the waste tank ventilation system to be seismically qualified.</p> <p>The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.</p>	C%	
6	DESIGN OF EQUIPMENT SYSTEMS AND THEIR SUPPORTING ELEMENTS (AA-4300) - Design Verification by Testing	AA-4350 To AA-4358	<p>Bolting requirements based on ASTM standards for flanges, manufacturers' requirements for housings, or other industrial standards define dimensions and material strength properties based on analysis, testing, or operational experience that demonstrate the required leak tightness and structural integrity for the expected loads for which the bolted connection is designed is applicable for waste tank ventilation systems. The requirements for nuclear power plant components from the ASME Code, Section III, are not required from an emission control standpoint for systems that are not required to withstand the demanding loading from seismic events or nuclear reactor accidents.</p>	NA	
7	DESIGN OF EQUIPMENT SYSTEMS AND THEIR SUPPORTING ELEMENTS (AA-4300) - Design of Bolts	AA-4360	<p>The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.</p>	C%	
8	DOCUMENTATION REQUIREMENTS (AA-4400) – Certification of Design Verification; Equipment Description; Safety Related Features; Report Content	AA-4400 to AA-4443	<p>The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.</p> <p>Design verification was conducted in accordance with the manufacturers' or tank farm contractor's procedures and quality assurance program. A certified DVR is not required. Additional design verification requirements may be included in the design specification.</p>	C%	
	INSPECTION AND TESTING	AA-5000	INSPECTION AND TESTING		

Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators	
				Flanders 40 cfm Filter	C%
9	GENERAL (AA-5100) – Scope and Applicability; Responsibility for Procedures; Measuring and Test Equipment Visual Inspection (AA-5200) – Scope; Description of Method; Requirements; Inspection Checklist; Reports Welded Connections (AA-5300)	AA-5110 to AA-5300	The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.  Inspection and testing is completed using written procedures by qualified personnel. Industry accepted quality assurance standards for control of M&TE is allowed, and subject to evaluation by the tank farm contractor. Visual inspections to industry codes or standards with similar inspection requirements may be performed as provided by the manufacturers' procedures.  Visual Inspection: The stringent visual inspection requirements of ASME AG-1 are not specifically required. Manufacturers of quality industrial components have established inspection procedures for their products as necessary to ensure satisfactory performance and reliability. A final AG-1 visual inspection of the installation is completed and documented in a work package prior to startup.		C%
10	BOLTED CONNECTIONS (AA-5400) – Before Bolting; After Bolting	AA-5400 To AA-5420	The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components.  Inspection and testing requirements for bolted connections is determined by the responsible engineer in accordance with the manufacturers' standard practices and considers the technical requirements of the specific bolted connection and importance of the bolted connection to control and monitoring of emissions. All components are not required to operate during or after a seismic event or accident. Fabrication tolerances are examined for critical components but not on non-critical components.		C%
11	FABRICATION TOLERANCES (AA-5500)	AA-5500	Leak testing of applicable pressure boundaries is completed to AG-1 code. Performance and functional testing is done for ventilation components to meet AG-1 or applicable Department of Energy practices.		C%
12	PRESSURE AND LEAK TESTING (AA-5600) PERFORMANCE AND FUNCTIONAL TESTING (AA-5700) SEISMIC TESTING (AA-5800)	AA-5600 To AA-5800			CC
	FABRICATION, JOINING, WELDING, BRAZING, PROTECTIVE COATING, AND INSTALLATION	AA-6000			
13	GENERAL (AA-6100) – Scope and Applicability; Materials; Control of Fabrication and Installation Processes	AA-6110 To AA-6130	Material requirements are defined in AA-8000.  The overall HEPA filter assembly meets the requirements in this section. Requirements following are generally specific to all other components.  Manufacturer's quality control procedures meet the basic requirements of ASME NQA 1 or are based on other accepted industry standards. The tank farm contractor shall evaluate them for acceptability requirements in AA-8000.		C%



Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators	
				Flanders 40 cfm Filter	
14	FABRICATION PROCESS (AA-6200) – Cutting; Forming and Bending; Forming Tolerances; Fitting and Aligning	AA-6200 To AA-6230	Pressure retaining parts are fabricated by standard industrial fabrication methods. Pressure retaining parts are fabricated and designed to withstand much higher pressures than the 20 inches WG rating of this ventilation system. Subsequent pressure testing is done as applicable. Standard industrial or manufacturer's tolerances and inspections are used.	C%	
15	FABRICATION PROCESS (AA-6200) – Welded Joints	AA-6240	Standard industrial or manufacturers' methods and procedures are acceptable. The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components. Documentation of welds on fabrication drawings is not required. Welding shall be performed in accordance the manufacturers' welding procedures based on standard industrial welding processes. The successful operating history of the manufacturers supplied standard industrial components demonstrates the adequacy of the standard industrial welding processes used by the manufacturers.	C%	
16	FABRICATION PROCESS (AA-6200) – Mechanical Joints	AA-6250 To AA-6258	The HEPA filter assembly meets the requirements in this section. The following requirements are generally specific to all other components. Use of thread fasteners, associated thread engagement, locking devices including hardened washers, and lubrication was based on application, vibratory loads, and overall torque value. Calculations are not required as accepted manufacturers' engineering practices or industry standards are allowed to determine the specified fastener requirements. Standard bolt design practices were used that conform to this requirement. Bolts are torqued to design or manufacturer's specifications as applicable. Where bolt torque is not listed, site standard torque practices are used. A graded approach for the use of hardened bolts and washers is based on field use and testing. Locking devices are determined by the responsible engineer base on the vibratory loads expected during system operation.	C%	
17	WELDING REQUIREMENTS (AA-6300) - General; Workmanship; Inspection and Testing of Welds	AA-6300 to AA-6336	The HEPA filter assembly meets the requirements in this section. For other components, welding may be performed in accordance with the manufacturers' welding procedures based on standard industrial welding processes.	C%	
18	BRAZING (AA-6400) - General; Workmanship; Cleaning; Inspection and Testing	AA-6400 To AA-6434.1	The successful operating history of the manufacturers supplied standard industrial components demonstrates the adequacy of the standard industrial welding processes used by the manufacturers. The HEPA filter assembly would be required to meet the requirements in this section; however, no brazing was used.	NA	

Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators	
				Flanders 40 cfm Filter	
19	CLEANING AND COATING (AA-6500) – General; Surface Preparation; Coating; Repair of Coating System; Inspection; Quality Assurance Requirements and Documentation	AA-6500 To AA-6560	Use of standard industrial and manufacturer's processes, procedures, inspections, and documentation is adequate for these systems. Stainless steel surfaces are not coated.	C%	
20	INSTALLATION REQUIREMENTS (AA-6600) – Handling and Rigging	AA-6600 To AA-6610	Handling and rigging requirements requires the use of Hanford site procedures. The key component requiring AG-1 type handling and rigging is the HEPA filter assembly that has all the major ventilation components. The HEPA filter assembly has written handling and transport controls.	C%	
21	INSTALLATION REQUIREMENTS (AA-6600) – Field Assembly & Temporary Field Attachments	AA-6620 To AA-6630	Field assembly is controlled by released drawings and work documents. Field assembly components include this information as applicable.	C%	
	PACKAGING, SHIPPING, RECEIVING, STORAGE, AND HANDLING	AA-7000	Temporary field attachments are controlled by released work documents.		
22	GENERAL (AA-7100) – Scope and Applicability; Responsibility GENERAL REQUIREMENTS (AA-7200) – Planning, Procedures, and Instructions; Personnel Qualifications; Classification of Items PACKAGING (AA-7300) – General; Level of Packaging SHIPPING (AA-7400) – General	AA-7100 To AA-7410	The HEPA filter assembly meets the packaging, shipping, and storage requirements of this section. All other components may use manufacturer's recommended practices.  Qualified quality control personnel inspect, exam, and test components as applicable.  Items are classified depending on many factors including environmental factors, storage location, protection level required, etc.  Packaging is done to Hanford site procurement procedures that incorporate the features of this section as applicable.  Shipping is done to Hanford site procurement procedures that consider the protection classification.	C%	
QUALITY ASSURANCE		AA-8000	QUALITY ASSURANCE		



Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators
23	GENERAL (AA-8100) – Scope and Applicability; Responsibility; Responsibilities of Fabricators, Material Suppliers, and Material Manufacturers	AA-8100 To AA-8130	<p>Flanders has been evaluated in accordance with the CH2M HILL NQA-1 quality assurance program and is an NQA-1 approved evaluated supplier of HEPA filters. Flanders states in their published literature (Flanders's Bulletin 936D page 2) that their Quality Assurance Program "meets the requirements of ANSI/ASME NQA-1 and 10CFR50 Appendix B." that should meet the requirements of AA-8000.</p> <p>Manufacturer(s)'s quality assurance (QA) program meets the requirements of ASME NQA 1 and is based on accepted industry standard meeting the requirements of ASME NQA-1. NOTE: Manufacturer of HEPA filters, HEPA filter frames, and HEPA filter housings has a quality assurance program based exclusively on ASME NQA-1.</p> <p>The tank farm contractor periodically evaluates vendor QA programs for acceptability. Vendor QA programs can be based on QA program requirements other than ASME NQA-1 as long as the vendor's QA program is shown by evaluation to be equivalent to being based on NQA-1. As the requirement is stated, the quality assurance program does not have to be certified in accordance with ASME NQA -1, as long as the requirements specified as applicable in procurement documentation are addressed. The tank farm contractor has a quality assurance program compliant with ASME NQA-1 and has experience in evaluating quality assurance programs. The tank farm contractor's graded approach causes consideration of the ASME AG-1 requirements for quality assurance, and is used to establish the applicable QA program requirements passed to vendors in procurement documents. Guidance on the use of a graded approach to quality is provided in ASME NQA-1, Appendix 2A-2, Section 502. The manufacturer is listed on the Hanford site evaluated suppliers list.</p> <p>QA program requirements are flowed down to vendors through procurement documents. Additional quality assurance requirements of specific items are passed on by the tank farm contractor as applicable.</p> <p>The tank farm contractor has procedures in place for assuring fabricators, material suppliers, and material manufacturers deliver the intended product. Records and documentation for QA program compliance are generated and retained in accordance with the tank farm contractor's QA program.</p>	Flanders 40 cfm Filter C%

Item	Division I – General Requirements Section Headings	Requirement Source / Sec #	Division I – General Requirements Requirement Compliance	Status Indicators	
				Flanders 40 cfm Filter	
24	IDENTIFICATION AND CONTROL OF ITEMS (AA-8200) – Documentation; Identification and Completed Item; Marking Requirements for Small Products; Certified Material Test Reports; Records of Examinations and Tests QUALITY ASSURANCE RECORDS (AA-8300)	AA-8200 To AA-8300	Standard industrial practices are used for documentation. Requirements as specified in design or procurement specifications are kept in vendor files as permanent records in accordance with the tank farm contractor's quality assurance program. This documentation assures compliance with a quality assurance program subject to the discussions in AA-8110. Control of welding filler metal is in accordance with the manufacturers' welding processes as stated in AA-6300.  Marking and identification are based on standard industry practices.  Certified Material Test Reports when required include the information in AA-8240.  Testing records follow Hanford or standard industrial practices that meet the intent of this section.  Quality Assurance records as discussed in AA-8110 are used.	C%	
25	NAMEPLATES AND STAMPING GENERAL (AA-9100) – General; Requirements; Attachment of Nameplates; Location of Nameplates	AA-9000 AA-9110 To AA-9140	NAMEPLATES AND STAMPING  Item constructed in accordance with the ASME AG-1 Code are identified on the component.  Manufacturer's standard nameplates shall be required. Information required by ASME AG-1, such as capacity and operating temperature and pressure may be impractical for manufacturers to include on component nameplates. Standard nameplates include adequate information necessary to verify correct installation, such as make, model number, and serial number. This information also allows traceability to additional technical information, if required, during system operation.  Nameplates attachments by standard industrial practices follow this requirement. During assembly, any nameplate that interferes with operation is relocated as appropriate.  Nameplates may not be shown on drawings. Showing the nameplate location on manufacturer's drawings may be impractical. Compliance with the other provisions of this section ensures adequate accessibility to the nameplate.	C%	



## A.10 SECTION FC (HEPA Filters)

The Flanders 40 cfm Radial HEPA filter is evaluated in ASME AG-1 Section FK for Special HEPA Filters. Section FC-I is included in this analysis because FK requires compliance with section FC-I for filter media. All other portions of Section FC are not applicable to this HEPA filter design. The 40 cfm Radial HEPA filter uses the same HEPA filter media as the HEPA filters currently used for both passive and active ventilation systems on single shell tanks, therefore, compliance of the HEPA filter media for the 40 cfm Radial HEPA filter is achieved in the same manner as in other applications.

Item	Division II - Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
	FILTER MEDIA-FIRE RESISTANT, HIGH EFFICIENCY	Mandatory Appendix FC-I		
46	Scope: This Code Appendix establishes requirements for the manufacture of high efficiency, fire-resistant, filter media for use in the construction of HEPA filters as described in Section FC. This Appendix supersedes and has been derived from the Military Specification MIL-F-51079D for Fire Resistant, High Efficiency Filter Media.	FC-I-1000.	The HEPA filter manufacturer Flanders' states in its published literature (Bulletin No. 936D) that it meets all the requirements of this Appendix FC-I by the following statement "FFI manufactures its own filter media to meet or exceed the requirements of MIL-F-51079 (latest issue) and/or ASME AG-1 Section FC, Article I-3000. FFO'007" media is currently listed on the U.S. Army Qualified Products List QLP 51079. This media meets the requirements of ASME AG-1 Section FC, Article I-3000."	CC
	REQUIREMENTS	FC-I-3000	The HEPA filters used are '007" media.	
47	Form: The filter media shall be furnished in rolls. The medium shall be tightly and evenly wound on non-returnable fiber or paperboard cores with a minimum inside diameter of 3 1/16 +/- 1/8 in. and a minimum wall thickness of 3/8 in. Unless otherwise specified in the contract or purchase order, the roll diameter shall not exceed 25 in. in diameter.	FC-I-3110	See FC-I-1000.	CC
48	Size: The width of the roll shall be specified at the time of procurement. The tolerance on the specified width shall be +1/4 in. and -0. The length of media on the roll shall be clearly marked on the outside of the roll. The length shall not include the first wrap around the core or the outermost wrap of the roll.	FC-I-3120	See FC-I-1000.	CC
49	Splices: The location of splices within the rolls shall be marked with paper tabs of contrasting color extending from each end of the roll. The number of splices permitted per roll shall not exceed the whole number obtained by dividing the length of the roll in feet by 1000.	FC-I-3130	See FC-I-1000.	CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
50	<b>Airflow Resistance:</b> The pressure drop across the media shall not exceed 1.6 in. WG with ambient temperature airflow through the media at a minimum velocity of 10 ft/min when tested as specified in I-4221.	FC-I-3210	See FC-I-1000 and FK-5000.	CC
51	<b>Test Aerosol Penetration:</b> The penetration of the media by test aerosol of 0.3 micrometer average particle size shall not exceed 0.03%, as determined by comparing upstream with downstream aerosol concentration with the air and aerosol mixture having the flow rate specified in I-3210 when tested in accordance with I-4221.	FC-I-3220	See FC-I-1000 and FK-5000.	CC
52	<b>Tensile Strength and Elongation:</b> The average tensile breaking strength of the media shall be not less than 2.5 lb/in. width in the machine direction, no less than 2.0 lb/in. width in the cross direction, and the average elongation in both directions shall be no less than 0.5% at rupture when tested as specified in I-4222(a).	FC-I-3231	See FC-I-1000.	CC
53	<b>Tensile Strength After Heated Air:</b> The average tensile strength of the media shall be not less than 0.6 lb/in. width in the cross direction after exposure to heated air at 700 +/- 50 degrees F in a forced draft oven for 5 min when tested as specified in I-4221(b).	FC-I-3232	See FC-I-1000.	CC
54	<b>Wet Tensile Strength:</b> The average wet tensile breaking strength of the media after being soaked for 15 min. in water at room ambient temperature shall be not less than 1.0 lb/in. of width in the cross direction when tested as specified in I-4221(c).	FC-I-3233	See FC-I-1000.	CC
55	<b>Tensile Strength After Gamma Irradiation:</b> The average tensile strength of the filter media shall not be less than 1.0 lb/in. of width in either the machine or cross direction after the media is exposed to gamma irradiation for an integrated dose rate not to exceed 2.5 megarads per hour when tested as specified in I-4222(d).	FC-I-3234	See FC-I-1000.	CC
56	<b>Water Repellency Prior to Irradiation:</b> The average water repellency of the filter media shall not be less than 20 in. WG with no single value being less than 18 when tested as specified in I-4223(a).	FC-I-3240 FC-I-3241	See FC-I-1000	CC
57	<b>Water Repellency After Gamma Irradiation:</b> The average water repellency of the filter media shall not be less than 6 in. WG with no single value being less than 5 after the media is exposed to an integrated dose of $6.0 \times 10^7$ to $6.5 \times 10^7$ rads at a dose rate not to exceed 2.5 megarads per hour when tested in accordance with I-4223(b).	FC-I-3242	See FC-I-1000.	CC
58	<b>Acidity:</b> The pH of the media shall be between 6.0 and 8.0 when tested as specified in I-4244.	FC-I-3250	See FC-I-1000.	CC



Item	Division II - Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
59	Thickness: Media thickness shall be a minimum of 0.015 in. and a maximum of 0.040 in. when measured as specified in I-4225.	FC-I-3260	See FC-I-1000.	CC
60	Combustible Material: The combustible material in the filter media shall not exceed 7% by weight when tested as specified in I-4226.	FC-I-3270	See FC-I-1000.	CC
61	Flexing: The media shall show no tears, breaks, cracks, or fiber separation after it is drawn back and forth, five times, around a 3/16 in. dia. Mandrel and moving through an arc of at least 180 deg. When tested as specified in I-4227.	FC-I-3281	See FC-I-1000.	CC
62	Test Aerosol Penetration: The penetration of the media by test aerosol of essentially 0.3 micron particle size when determined as stated in I-3220 and specified in I-4221 shall not exceed 0.03% after the media is drawn back and forth as required in I-3281, when tested as specified in I-4221.	FC-I-3282	See FC-I-1000 and FK-5000.	CC
63	Workmanship: The medium shall be free from contamination (foreign matter), thick or thin spots, wrinkles, and damage, such as tears, cracks, holes, abrasions, and punctures.	FC-I-3300	See FC-I-1000.	CC
64	Supplier's Responsibility: Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein.	FC-I-4110	See FC-I-1000.	CC
65	Objective Evidence: The supplier shall provide objective evidence acceptable to purchaser that the requirements of Articles I-3000 and I-5000 have been satisfied.	FC-I-4120	See FC-I-1000.	CC
66	Qualification Sample: A qualification sample of 10 linear ft., full width, shall be manufactured using the same methods, materials, equipment and processes as will be used during regular production.	FC-I-4200 FC-I-4210	See FC-I-1000.	CC
67	Material Change: Any change in materials or source of materials after qualification shall require a new qualification sample.	FC-I-4211	See FC-I-1000.	CC
69	Reverification of Qualification: Media shall be re-qualified at least every five years. Tests shall be performed and certified by an independent test facility.	FC-I-4212	See FC-I-1000 and FK-5000.	CC
	Test Procedures	FC-I-4220		

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter CC
70	Airflow Resistance and DOP Smoke Penetration: Three test specimens shall be tested for airflow resistance and DOP smoke penetration at a flow rate of 1.1 cfm using the Q127 DOP Filter Testing Penetrometer (Drawing 136-42-102-5B). The exposed test area of the specimens is 16 in. <sup>2</sup>	FC-I-4221	See FC-I-1000.	CC
71	Tensile strength and Elongation: Ten test specimens, five taken in each direction, shall be tested for tensile strength and elongation in accordance with TAPPI Standard T494 except that the test specimens shall be 1 by 6 in. (shear cut) and the jaw separation shall be 4 in. Use a motorized tensile testing machine which has a constant rate of elongation (see 6.7) and uses a flat jaw clamping device at a loading rate of 0.5 in. per min or at a loading rate which will complete the test in 10 +/-2 sec, which ever is greater.	FC-I-4222(a)	See FC-I-1000.	CC
72	Tensile Strength After Heated Air: Four test specimens (6 by 6 in.) shall be subjected to heated air using a suitable commercial forced draft oven, capable of allowing full circulation of air to each test specimen. The test specimen shall be placed in the oven for five min after the temperature has reached 700 degrees F. After the exposure, the specimen shall be removed from the oven and conditioned in accordance with TAPPI Standard T402. One test strip, 6 in. in cross direction and 1 in. wide, shall be shear cut from each test specimen and tested for tensile strength in accordance with I-4222(a).	FC-I-4222(b)	See FC-I-1000.	CC
73	Wet Tensile Test: Three test specimens 1 by 6 in. taken in the cross direction shall be submerged in water at a depth of 10 in. for 15 min. and then tested for tensile strength as specified, I-4222(a).	FC-I-4222(c)	See FC-I-1000.	CC
74	Tensile Strength After Gamma Irradiation: Six test specimens, 7 by 3 in. three with the 7 in. side in the machine direction and three with the 7 in. side in the cross direction shall be exposed to irradiation in a ventilated chamber as specified in I-3234. After exposure and conditioning, eight test strips 7 by 1 in. shall be shear cut; four with the 7 in. side in each direction. The tensile strength of each strip shall be determined in accordance with I-4222(a).	FC-I-4222(d)	See FC-I-1000.	CC



Item	Division II - Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
75	Water Repellency Prior to Gamma Irradiation: Three test specimens 2 1/2 by 5 1/2 in. rectangles shall be conditioned (4.2.3) and tested for water repellency using the Q101 Water Repellency Indicator (125-8-1). The two surfaces of each test specimen shall be identified as top and bottom. The specimen shall then be cut into two equal squares. The top surface of one square and the bottom surface of the other square shall be tested. The lesser of the two results shall be considered the water repellency of the specimen.	FC-I-4223 FC-I-4223(a)	See FC-I-1000.	CC
76	Water Repellency After Gamma Irradiation: Three test specimens 7 by 3 in. shall be irradiated in a ventilated chamber as specified in 3.2.4.2. After exposure each test specimen shall be cut to form three test specimens 2 1/2 by 5 1/2 in. rectangles and tested in accordance with I-4223(a).	FC-I-4223(b)	See FC-I-1000.	CC
77	Acidity: The pH of two specimens from each sample shall be determined in accordance with TAPPI uniform method UM-440.	FC-I-4224	See FC-I-1000.	CC
78	Thickness: The thickness of the medium shall be determined in accordance with TAPPI Standard T411.	FC-I-4225	See FC-I-1000.	CC
79	Combustible Material: The dried weight of the sample shall be recorded. The ash weight of the sample shall be determined as specified in TAPPI Standard T413...	FC-I-4226	See FC-I-1000.	CC
80	Flexing Characteristics - Examination: Eight test specimens, cut 12 in. long in the machine direction and 6 in. wide shall be bent perpendicular to the machine direction over 3/16 in. Wide mandrel and drawn back and forth so that 10 in. of medium are drawn five times through an arc of 180 deg. Four specimens with the screen/wire side against the mandrel and four specimens with the felt side against the mandrel shall be flexed. Examine the flexed 10 in. section for compliance with I-3281.	FC-I-4227(a)	See FC-I-1000.	CC
81	Flexing Characteristics - Test: After examination as specified in I-4227(a), the center of each test specimen shall be tested for DOP penetration in accordance with the procedure of I-4221 for compliance with I-3282.	FC-I-4227(b)	See FC-I-1000.	CC
82	Acceptance/Rejection Criteria: If a sample fails when tested as specified in I-4220, the lot represented shall be rejected.	FC-I-4230	See FC-I-1000.	CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
83	Quality Conformance Inspection: Each roll of media shall be examined for defects. Defects such as abrasions greater than ¼ in. diameter; cuts; holes; tears; punctures exceeding 1/16 in.; thick or thin spots greater than ¼ in. in diameter; burn holes, charring or scorching from the drying operation; and deviations outside the width tolerance +1/4 in. -0 are reasons for rejection.	FC-I-4300	See FC-I-1000.	CC
84	Packaging and Shipping Packaging: Packaging shall conform to Level B of ASME NQA-2 suitable for storage under Level B of ASME NQA-2.	FC-I-5000 FC-I-5100	See FC-I-1000 and FK-7000.	CC
85	Shipping: Shipping of the media shall be undertaken to assure the quality of the product upon arrival at the purchaser. Shipping containers shall comply with the rules and regulations applicable to the mode of transport being utilized.	FC-I-5200	See FC-I-1000 and FK-7000.	CC



# **A.18 SECTION FK (Special HEPA Filters)**

This section of ASME AG-1 was completed and approved in September 2005, and will be incorporated in the 2006 addenda to AG-1. This section is applicable to this filter design, and is evaluated herein for compliance with AG-1 in all aspects.

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
	SECTION FK: Special HEPA Filters	FK		
	INTRODUCTION	FK-1000		
1	<p><b>Scope:</b> This section of the Code provides requirements for the performance, design, construction, acceptance testing, and quality assurance for high efficiency particulate air (HEPA) filters constructed for radial flow, circular axial flow, rectangular duct-connected configurations, and rectangular axial flow.</p> <p><b>Purpose:</b> The purpose of this Code is to assure that special HEPA filters used in nuclear applications are acceptable in all aspects of performance, design, construction, acceptance, and testing.</p> <p><b>Applicability HEPA Filters:</b> This Section applies to extended-media, dry type filters for use in air and gas streams with a 250 degree F maximum continuous temperature. Four types of special HEPA filters are addressed:</p> <ul style="list-style-type: none"><li>a. Type 1: Radial flow filters</li><li>b. Type 2: Axial flow circular filters</li><li>c. Type 3: Axial flow rectangular or circular filters with inlet and/or outlet connections</li><li>d. Type 4: Axial flow rectangular filters that re size variations of those addressed in Section FK</li></ul> <p>Type 1, 2, and 3 filters are depicted in Figure FK-4100-1 through FK-4100-8. Type 4 filters are depicted in Section FK. Four types of filter pack are addressed:</p> <ul style="list-style-type: none"><li>a. Type A: Folded filter media with corrugated separator/supports</li><li>b. Type B: Mini-pleat medium with glass fiber or noncombustible thread separators</li><li>c. Type C: Continuous corrugated filter media folded without separators.</li><li>d. Type D: Folded filter media with glass fiber ribbon separators of glass fiber media or noncombustible threads glued to the filter media</li></ul>	FK-1100 FK-1110 FK-1120 FK-1121	<p>These filters are supplied by Flanders Filters Inc., which is recognized on the evaluated suppliers list as a qualified supplier for Nuclear Grade HEPA filters systems. The HEPA filters used are Type 1 (Radial Flow Filters) with Type C filter pack. Flanders HEPA filter part number used is #O-007-1-12-RF-NU-00-E3-Z04059B or current equivalent. Filter part number indicates filter construction.</p> <p>Flanders is a major supplier of nuclear grade HEPA filters and the primary source for the Hanford site and on the evaluated supplier list for HEPA filters.</p> <p>This low flow rate filter design uses the same type of materials and the same construction methods and materials as HEPA filters historically used on the Hanford site.</p>	CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
2	<p>Limitations: This section does not cover:</p> <ul style="list-style-type: none"> <li>(a) Filter mounting frames.</li> <li>(b) Integration of HEPA filters into air cleaning systems</li> <li>(c) Filter housings and ducting, including ducting and housing related pressure boundary and structural capability requirements</li> <li>(d) Filters listed in Section FC</li> </ul>	FK-1122	These requirements are addressed in other sections of AG-1.	NA
3	<p>Service Life: HEPA filters are components of a nuclear air treatment system that degrade with service. The user/owner of the facility shall incorporate written specifications on the service life of the HEPA filters for change-out criteria. Non-Mandatory Appendix FK-A provides guidance on determining the acceptable service life for each application of HEPA filters.</p> <p>MATERIALS</p> <p>Cases, End-Caps, Grilles, and Flange Materials: The case, end-caps, grilles, and flanges shall be made from stainless steel Type 409, 304, 304L, 316, or 316L per ASTM A240.</p> <p>The case for rectangular axial flow filters, if constructed from wood, shall be made from the following materials: (a) Marine plywood, minimum Grade A (interior side) and minimum Grade B (exterior side), APA PS-1. The minimum thickness shall be ¾ in. (19 mm). The grade shall be fire retardant treated. The plywood shall have a flame spread classification of 25 or less when tested as specified in ASTM E84. This material is not allowed for Type 3 circular filters. (b) Exterior plywood, minimum Grade A (interior side) and minimum Grade C (exterior side), APA PS-1. The minimum thickness shall be ¾ in. (19 mm). The grade shall be fire retardant treated. The plywood shall have a flame spread classification of 25 or less when tested as specified in ASTM E84. This material is not allowed for Type 3 circular filters.</p>	FK-1123	HEPA filters procured for use on the Hanford site are tracked for service life from the date of purchase. The established service life for each filter is based upon manufacturer recommendations and operational history with the filter.	CC
4	<p>Cases, End-Caps, Grilles, and Flange Materials: The case, end-caps, grilles, and flanges shall be made from stainless steel Type 409, 304, 304L, 316, or 316L per ASTM A240.</p> <p>The case for rectangular axial flow filters, if constructed from wood, shall be made from the following materials: (a) Marine plywood, minimum Grade A (interior side) and minimum Grade B (exterior side), APA PS-1. The minimum thickness shall be ¾ in. (19 mm). The grade shall be fire retardant treated. The plywood shall have a flame spread classification of 25 or less when tested as specified in ASTM E84. This material is not allowed for Type 3 circular filters. (b) Exterior plywood, minimum Grade A (interior side) and minimum Grade C (exterior side), APA PS-1. The minimum thickness shall be ¾ in. (19 mm). The grade shall be fire retardant treated. The plywood shall have a flame spread classification of 25 or less when tested as specified in ASTM E84. This material is not allowed for Type 3 circular filters.</p>	FK-3000 FK-3100 FK-3110	Flanders uses Type 304L stainless steel for construction of all metallic components of the 40 cfm Radial flow filter discussed in this document.	CC



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
5	<p>Fasteners: Approved fasteners used for the assembly of HEPA filter cases are listed below:</p> <ul style="list-style-type: none"> <li>(a) Stainless steel bolts, 300 series per ASTM A320 or ASTM A193</li> <li>(b) Stainless steel nuts, 300 series per ASTM A194</li> <li>(c) Stainless steel lock washers, 300 series per ANSI B18.21.1</li> <li>(d) Stainless steel plain washers, 300 series per ANSI B18.22.1</li> <li>(e) Stainless steel rivets 300 series per ASTM A581</li> <li>(f) Zinc-coated carbon steel nails per FF-N-105B</li> </ul> <p>Consideration shall be given when selecting the proper filter fasteners serving seismic and other unusual requirements. Uncoated carbon steel fasteners are not allowed.</p>	FK-3111	The Flanders 40 cfm Radial flow filter discussed in this document uses all welded joints.	NA
6	<p>GASKET MATERIAL</p> <p>Elastomer: Oil resistant, closed cell expanded cellular elastomer in accordance with grade 2C3 or 2C4 of ASTM D 1056, with the physical requirements specified for ASTM D1056 Cellular rubbers classified as Type 2, Class C, Grade 3 (2C3), or Type 2, Class C, Grade 4 (2C40).</p> <p>Gelatinous Seal: A self-adhesive and self-healing cured gel seal made of Polydimethylsiloxane.</p>	FK-3120 FK-3121	There is no external gasket used for sealing in this filter design. Filter pack to frame seal used on the top and bottom faces is a fire-retardant solid urethane that is compliant with ASME AG-1 Section FC-3150.	NA
7		FK-3122	Filter pack to frame seal used on the top and bottom faces is a fire-retardant solid urethane that is compliant with ASME AG-1 Section FC-3150. There is no external gasket used for sealing in this filter design.	NA
8	<p>Filter Media: The filter media shall conform to the requirements of Appendix FC-I.</p>	FK-3130	See Section FC-I.	CC
9	<p>Faceguards: Metallic faceguards shall be fabricated from 4 x 4 mesh, wire fabric (hardware cloth) made from 0.025 in. (0.64 mm) minimum steel conforming to either ASTM A 740 galvanized steel or ASTM A 580 Type 304 stainless steel.</p>	FK-3140	<p>The Flanders 40 cfm Radial filter discussed in this document is equipped with an expanded metal cover over the filter media. This cover serves the dual function of a grille, and a faceguard, and it complies with the requirements for both.</p> <p>Faceguards/Grilles are specified for corrosive environments that exceed this requirement and made from 18-gauge (0.0403 in) type 304 stainless steel expanded metal mesh.</p>	CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators:
10	Adhesives: Adhesives used to fasten gaskets to filter case, and seal the filter pack or faceguards to the case shall be self-extinguishing.	FK-3150	These filters were ordered to be compliant with UL-586. See text from Section FC-3150 below:  Adhesives used to splice the media, fasten gaskets to filter frame, and seal the filter pack or faceguards to the frame shall be self-extinguishing as evidenced by testing in accordance with the spot-flame test of FC 5160 or UL-586.	Flanders 40 cfm Filter CC
11	Separators: (a) Aluminum – Aluminum separators shall be made from corrugated aluminum, 0.0015 in. (0.038 mm) thick, min. conforming to ASTM B 209, Alloy 5052, 3003, 1100, or 1145 aluminum. To protect the filter media, the separators shall be provided with a hemmed edge. (b) Acid-Resistant Aluminum – Acid resistant aluminum shall be made from corrugated aluminum, 0.0015 in. thick, min., conforming to ASTM B 209, Alloy 5052, 3003, or 1145 coated on both surfaces with a vinyl-epoxy coating. The coating shall be tinted to verify coverage of the separator. To protect the filter media, the separators shall be provided with a hemmed edge. (c) Glass Ribbon – glass ribbon separators shall be ribbons of glass fiber media bonded to the filter media. (d) String – String separators shall be threads of non-combustible material bonded to the filter media. (e) Hot Melt – Hot melt separators shall be a non-combustible material bonded to the filter media.	FK-3160	Separators are not used in this filter.	NA
12	Coating: Separators coated in accordance with FK-3160 (b), shall meet the following tests after the application of the coating to the separator: (a) The coating shall meet or exceed an adhesion rating of 3A when tested using Method A (X-Cut Tape Test) of ASTM D 3359. The X-Cut specimen shall be inspected for removal of coating where the 3A adhesion rating equates to jagged removal along the X-cut incision up to 1/16 in. (1.6mm). (b) Off-gas volatiles, as determined by thermogravimetric analysis, shall not exceed 5% by weight when a 2 in. $\pm$ 0 in. (50 mm $\pm$ 0 mm) high by 2 in. $\pm$ 0 in. (50 mm $\pm$ 0 mm) wide sample of the coated separator is subjected to temperatures from 70°F (20°C) to 1800°F (1000°C). (c) The coated separator shall pass a flexibility test in accordance with FED-STD-141D, Method 6221.	FK-3161	Separators are not used in this filter.	NA



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
13	Separatorless Filter Packs: Separatorless filter packs shall use formed media to fulfill the function of the separator.	FK-3162	The Flanders 40 cfm Radial Filter uses a folded sheet of continuous media to fulfill the function of a separator.	CC
14	Grilles: Type 1 filters shall be fitted with an internal and external perforated grille or flattened expanded metal grilles as shown in Figure FK-4100-1 through Figure FK-4100-4. Flattened expanded metal grilles shall conform to ASTM F 1267 fabricated from the materials indicated in FK-3110. Grilles shall be 18 gauge (minimum).	FK-3170	The Flanders 40 cfm Radial filter discussed in this document is equipped with an expanded metal cover over the filter media. This cover serves the dual function of a grille, and a faceguard, and it complies with the requirements for both.  Flanders uses Type 304L stainless steel for construction of all metallic components of the 40 cfm Radial flow filter discussed in this document.  Faceguards/Grilles are specified for corrosive environments that exceed this requirement and made from 18-gauge (0.0403 in) type 304 stainless steel expanded metal mesh.	CC
15	General Material Requirements: All materials used shall have properties and composition suitable for the application as defined by the operating environmental conditions, as defined in FK-4200. When the application requires the use of specific materials, these materials shall be explicitly defined in the Design Specification. All materials expressly prohibited or limited shall be explicitly described in the Design Specification.  The material requirements of Article AA-3000 apply.	FK-3200	No specific requirement stated. However, material requirements for HEP A filters used on the Hanford site are defined in the applicable procurement specification.	NA

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
16	<p>Special Limitations of Materials: Materials suitable for the conditions shall be stated in the Design Specification, with special attention being given to the effects of service conditions upon the properties of the materials. The consideration of deterioration of materials caused by service is generally outside the scope of this Code.</p> <p>It shall be the responsibility of the Owner or Engineer to identify the environment and filter service conditions in which the filter must operate.</p> <p>Service conditions shall include air stream and gas stream contaminants that can affect the operability, service life, maintainability, or need for special features as to construction or materials of the filter in which the filter must operate.</p>	FK-3210	<p>No specific requirement stated. However, consideration for deterioration was considered. Some examples are: The upgrade of HEPA filter frames to use 304L stainless steel. The use of UL-586 compliant resin to provide the sealing mechanism for the filter media to the frame, and the use of an NPT pipe thread to seal to the tank system. This eliminates the need for either Blu-Jel sealant or Neoprene gaskets which have both caused problems in the past. The UL-586 resin has proven to be very reliable and problem free in tank farm applications and the NPT thread provides a leak-free method of attachment that cannot be installed improperly.</p> <p>Environment and service conditions for HEPA filters to be used on tank farm facilities are considered for each application, and replacement frequencies are adjusted based on past operational experience.</p>	NA
17	<p>Alternate Materials: Materials, other than those referenced in this code section, found acceptable by the qualification tests of FK-5000, and the design requirements of FK-4000 and Section AA will be acceptable for the fabrication of filters.</p>	FK-3220	No alternate materials were used.	NA
18	<p>DESIGN</p> <p>General Design: Four types of HEPA filters are addressed in this code section:</p> <p>Type 1: Radial flow HEPA filters Type 2: Axial flow circular HEPA filters Type 3: Axial flow rectangular or circular HEPA filter with inlet and/or outlet connections Type 4: Axial flow rectangular HEPA filters that are size variations of those addressed in Section FC.</p> <p>The total media area provided within the filter pack shall be such that maximum media velocity is 5 ft/min (1.5 m/min) at the rated flow.</p> <p>HEPA filters not listed above which conform to the performance, material, construction, acceptance, and testing requirements listed in this code section are acceptable.</p>	FK-4000 FK-4100	<p>The Flanders 40 cfm Radial filter is a Type 1 HEPA filter.</p> <p>This filter design does not fall within the bounds of the 5 ft/min media velocity requirement at the rated flow of 40 cfm. However, the design flow rate for tank farm passive ventilation systems is 10 cfm, the filter media velocity is 1.5 ft/min at the design flow rate.</p> <p>Using a graded approach based on applicability of the requirement to actual operating conditions the face velocity restriction of 5 ft/min at the rated flow of 40 cfm is not applicable to the passive ventilation systems for SSTs. The actual flow rates experienced during passive ventilation are on the order of 1/4 of the rated flow for the filter, this allows the actual operational media velocity for this filter to remain within the intent of this requirement.</p>	C%
	SPECIAL HEPA FILTERS	FK-4110		



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
19	<p>Type 1 Radial Flow Filters:</p> <p>Type 1 Radial flow filters shall be made from a media pack formed to produce an annulus with internal and external supporting grilles. The media pack and grilles shall be sealed into the flange and end cap with adhesive complying with FK-3150. The normal direction of flow shall be from the inside face to the outside face. Optionally, the flow may be from outside face to inside face as may be required for glove box installations or similar applications. The end cap shall blank-off the end of the filter. A handling mechanism will be provided if required by the application. The filter capacity and performance ratings shall be as specified in Table FK-4000-1.</p> <p>(a) Type 1 Radial flow filters with internal gaskets shall be constructed as depicted in Figure FK-4100-1. The filter shall accommodate a seal ring connected to the flange to provide a gasket seal between the filter and the sealing face of the housing. Gaskets shall comply with FK-3121.</p> <p>(b) Type 1 Radial flow filters with gelatinous seals shall be constructed as depicted in Figure FK-4100-2. The filter shall have a circular channel connected to the flange. The circular channel shall contain gelatinous sealant to provide a seal between the filter and a companion circular knife-edge on the housing. Gelatinous seals shall comply with FK-3122.</p> <p>(c) Type 1 Radial flow filters with external seals shall be constructed as depicted in Figure FK-4100-3. The filter shall accommodate an external seal ring to provide a seal between the filter and the sealing face of the housing. Gaskets shall comply with FK-3121.</p> <p>(d) Type 1 Radial flow filters with gelatinous seals shall be constructed as depicted in Figure FK-4100-4. The filter shall have a circular channel connected to the flange. The circular channel shall contain gelatinous sealant to provide a seal between the filter and a companion circular knife-edge on the housing. Gelatinous seals shall comply with FK-3122.</p>	FK-4111	<p>The Flanders 40 cfm Radial filter discussed in this document is formed to produce an annulus with internal and external supporting grilles. The media pack is sealed to the end caps using UL-586 compliant adhesive (See Section FK-3150). The normal flow direction is from the inside face to the outside, and one end cap is blanked off as is required by this section. The filter is rated at 40 cfm with a clean filter resistance of 1.3 in. w.g., it complies with the requirements of Table FK-4000-1.</p> <p>This filter design is completely self-contained and does not utilize a housing, therefore it does not require any external sealing mechanisms, i.e. gelatinous seal or gasket.</p> <p>This filter design complies with the performance, material, construction, acceptance, and testing requirements listed in this code section. Section FK-4100 allows for alternate filter designs from those described in Article FK-4000 as long as they comply with these requirements. See Section FK-4100. Although this filter does not match the designs shown in Figures FK-4100-1 through FK-4100-4, it is compliant with the requirements of Section FK-4100.</p>	CC
20	<p>Type 2 Axial Flow Circular Filters</p> <p>Type 3 Axial Flow Rectangular Filters with Inlet and/or Outlet Connections</p> <p>Type 3 Axial Flow Rectangular Filters with Inlet and/or Outlet Connections</p> <p>Type 4 Axial Flow Rectangular Filters</p>	FK-4112 FK-4113 FK-4114 FK-4115	The Flanders 40 cfm Radial filter discussed in this document is a Type 1 Radial flow filter.	NA
21	<p>Splices and Patches:</p> <p>No splices or patches in the filter media pack are allowed. Joining of the two ends in a Type 1 Radial flow filter pack is acceptable.</p>	FK-4116	The Flanders 40 cfm Radial filter discussed in this document is a Type 1 Radial flow filter, the two ends of the filters pack are joined using UL-586 compliant adhesive.	CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
22	Filter End Cap, Grilles, and Flange: Filter end cap, grilles, and flanges for Type 1 radial flow HEPA filters are used to contain and support the filter media pack. All joints shall be sealed. End cap and flange materials shall be in accordance with FK-3110. Fabrication shall meet the requirements of Article FK-6000.	FK-4120	All joints between metal end caps, grilles, and flanges are welded, joints between metal components and filter media are sealed using UL-586 compliant adhesive.  See Sections FK-3110 and FK-6000.	CC
23	End-caps, Grilles, and Flanges for Type 1 Filters: End-caps, grilles, and flanges for Type 1 filters shall have a minimum material thickness of 18 gauge.	FK-4121	All end-caps, flanges, and grilles on this filter model are either 14 or 18 gauge 304L stainless steel.	CC
24	Cases for Type 2 Filters Cases for Type 3 and 4 Filters	FK-4122 FK-4123	This filter is a Type 1 Radial flow filter.	NA



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators:
25	<p><b>Filter Pack:</b></p> <p>(a) Type A filter packs shall be made by folding the media to the required depth. The folded filter media shall be supported with corrugated separators. The filter media pack shall not extend beyond the exposed ends of the separators. The separators shall not extend beyond the ends of the case when the media pack is bonded to the case. The filter pack shall be rigid within the frame and the separators shall be perpendicular to two opposite parallel sides of the case; circular filters are exempt from these requirements. Separators and media shall not vary more than ¼ in. (6 mm) from a straight line connecting the fixed ends. Type A filter packs, for axial-flow, circular Type 2 and Type 3 circular filters, shall have a ratio (D/d) of pack diameter (D) to pack depth (d) no greater than 3 to assure pack structural reliability.</p> <p>(b) Type B filter packs shall be made from a series of flat panels of pleated filter media which are assembled in a V shape. Pleats shall be separated and supported by ribbons of glass fiber media or noncombustible threads bonded to the filter media. When the panels are installed in the filter case, the top and bottom panels shall be sealed. Where two flat panels are assembled to for the V shape, the two flat panels shall be bonded by a common metal joint. Panel flatness, including separator, shall vary no more than ¼ in. (6 mm). No ribbons or media supports shall vary from a straight line by more than ¼ in. (6 mm). Side panels shall be securely bonded to the side of the filter case with adhesive.</p> <p>(c) Type C filter packs shall be made by corrugating or embossing a continuous sheet of filter media and folding media to the required depth to make the filter pack. When the media pack is installed in the filter case, the top and bottom of the media pack shall be embedded in the pack to frame adhesive/sealant. When installed in the case, the self supporting media convolute or embossed centers shall not vary more than ¾ in. (10 mm) top to bottom from a straight line drawn perpendicular to the top and bottom case; circular filters are exempt from these requirements. The media shall be folded such that the apex created by a media fold does not vary by more than 1/16 in. (1.6 mm) when compared to an adjacent media fold apex. Filter media or filter media supports, if used, shall not extend beyond the filter case. The filter pack shall be rigid within the case and there shall be no kinked media.</p>	FK-4130	Filter pack used is Type C and complies with these requirements.	Flanders 40 cfm Filter CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
25 (cont'd)	(d) Type D filter packs shall be made by folding the media to the required depth. The folded filter media shall be separated and supported by ribbons of glass fiber media or noncombustible threads glued to the filter media. The filter pack shall be rigid within the case and the media pleats shall be perpendicular to opposite parallel sides of the case. The top and bottom of the media pack shall be sealed in a reservoir of potting adhesive at least 1/16 in. (1.6 mm) deep when the media pack is installed in the filter case.			
	GASKETS	FK-4140		
26	Elastomer Gasket	FK-4141	No elastomer gaskets are used in this filter design. See FK-4111.	NA
27	Gelatinous Seal Gasket	FK-4142	No gelatinous seals are used in this filter design. See FK-4111	NA
28	Grilles: Type 1 filters shall be fitted with internal and external support grilles around the filter media. The support grilles and filter media shall be embedded in adhesive/sealant at the flange and end cap to provide structural strength of the filter. The method of attachment shall be the responsibility of the filter manufacturer.	FK-4150	The Flanders 40 cfm Radial filter is equipped with an expanded metal cover over the filter media. This cover serves the dual function of a grille, and a faceguard, and it complies with the requirements for both.  The grilles/faceguards installed on this filter are embedded in UL-586 compliant adhesive, and are mounted on both the inside and the outside faces of the filter.	CC
29	Faceguard: A faceguard shall be installed in each face of each filter type excluding Type 1 filters.	FK-4160	The Flanders 40 cfm Radial filter is equipped with an expanded metal cover over the filter media. This cover serves the dual function of a grille, and a faceguard, and it complies with the requirements for both.	CC



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter C%
30	<p>Performance Requirements: The Owner's design specification shall clearly establish the purpose (design function) of the filter and its safety classifications. The Owner's design specification shall include at a minimum the environmental and associated service conditions indicated in Table FK-4000-4.</p> <p>The Owner is cautioned that the most penetrating particle size may be less than 0.3 micrometers. It shall be the responsibility of the Filter Design/Manufacturer to test for and to identify the most penetrating particle size for the filter media to be installed. The Owner or Engineer shall confirm the suitability of the filter media for the specific application.</p> <p>Designs shall be qualified in accordance with Section FK-5000.</p>	FK-4200	<p>Design specifications are listed on drawing H-2-90718 sheet 18. These design requirements are for a typical breather filter application and they include the required information from Table FK-4000-4.</p> <p>This filter design uses the same media and adhesives that have historically shown successful performance for contamination control on Single Shell Waste Tanks. Compliance can be inferred due to similarity of material and fabrication techniques.</p> <p>The 40 cfm Radial filter is not currently qualified to Section FK-5000. The filter manufacturer may have plans to qualify it in the future, but that will not be a prerequisite for installation on Single Shell Tanks.</p> <p>Portions of the qualification requirements of ASME AG-1 Section FK-5000 will be performed on this filter design prior to its use on Single Shell Tanks. The specific portions of Section FK-5000 to be performed will be decided using a graded approach based on applicability of the test to actual operating conditions. See Section FK-5000.</p>	C%
31	<p>Structural Requirements: The HEPA filters shall be seismically qualified by test in accordance with AA-4350 when specified by the Owner. The acceptable criteria are:</p> <ul style="list-style-type: none"> <li>(a) No structural damage shall be evident by visual examination</li> <li>(b) Airflow resistance requirements of FK-5110 shall be met after the seismic qualification test</li> <li>(c) Aerosol penetration requirements of FK-5120 shall be met after the seismic qualification test</li> <li>(d) No cracked or warped cases</li> <li>(e) No loose joints</li> <li>(f) No cracked adhesive</li> <li>(g) No loose or deformed media, separators, or grilles</li> </ul> <p>The HEPA filter shall be mounted on the seismic qualification test machine in the same configuration as the in-service condition with the same sealing or clamping mechanism to provide a valid seismic qualification test.</p>	FK-4300	<p>The passive ventilation system for Single Shell Tanks at the Hanford site is not credited for containment in a seismic event. Seismic qualification of HEPA filters for SSTs is not required.</p>	NA
	QUALIFICATION, INSPECTION, AND PRODUCTION TESTING	FK-5000		

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
32	<p>Qualification Testing: New or revised Type 1 filter designs shall require qualification testing prior to acceptance and production. Filter designs shall be re-qualified at least every 5 years. Tests must be performed and certified by an independent test facility.</p> <p>A qualification sample of filters shall be manufactured using the same methods, materials, equipment, and processes as will be used during production.</p> <p>Qualification of a filter gasket or a gelatinous seal on one face qualifies the use of the same gasket or seal on both faces. The test sequence is detailed in Table FK-5000-1.</p> <p>Each Type 1 filter in the qualification sample shall be visually examined for any defects. The acceptance criterion for the filter pack is no visual indication of damage to the filter media, no tears on the surface edge of the filter pleats, and no tears where the filter pack is embedded in the adhesive at the flange and end cap. The acceptance criterion for the flange, grilles, and end cap is no visual indication of dents or deformation. The acceptance criterion for the gel channel and external seal ring is no visual indication of gouges or separation from the gel channel. The acceptance criterion for the elastomer seal is no visual indication of looseness or tears.</p> <p>Acceptance shall be contingent on no visual indications of improper assembly, physical damage, structural distress and no degradation that would impair the ability of a component to perform its intended function. The qualification samples shall be tested for all the requirements for this section. Failure of any filter to comply with the requirements of this section shall be cause for rejection of the qualification sample.</p>	FK-5100	This HEP A filter design will be tested prior to use on single shell tanks as is detailed in FK-5110 through FK-5160.	C%
33	<p>Resistance to Airflow: The clean filter resistance to airflow shall meet the requirements of Table FK-4000-1 when tested in accordance with FK-5120.</p>	FK-5110	Resistance to airflow testing will be included in the qualification testing of this filter.	CC



Item	Division II - Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter CC
34	<p>Test Aerosol Penetration:</p> <p>The test aerosol penetration shall be determined in accordance with Table FK-5000-1. The total aerosol penetration through the filter media, frame, and gasket or gelatinous seal shall be no greater than 0.03% of upstream concentration at rated airflow and at 20% of rated airflow when challenged with 0.3 micrometer particles.</p> <p>Filters with rated airflows less than 125 acfm will be tested at rated flow only.</p> <p>The Q-76 and Q-107 are suitable penetrometers whose construction and operation are described in MIL-STD-282, Method 102.9. Penetrometers using laser particle counters in accordance with the methods and procedures of IEST-RP-CC007 are also acceptable. When using a penetrometer with a particle counter, the penetration of the 0.3 micrometer particle size shall be reported.</p> <p>Acceptable aerosol methods for the penetrometer are diethylphthalate (DOP), dioctylsebacate (DOS) and 4 centistoke polyalphaolefin (PAO). If using a penetrometer with a particle counter, the aerosol material shall be 4 centistoke polyalphaolefin (PAO) or as defined in IEST-RP-CC007.</p>	FK-5120	Vendor aerosol penetration test will be included in the qualification testing for this filter. The penetration testing will only be done at 100% of rated flow because the filter is smaller than 125 acfm.	

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
35	Resistance to Rough Handling: Filters shall be tested on a rough handling machine for 15 min. at ¾ in. (19 mm) total amplitude at 200 cycles per min. in accordance with Test Method 105.10 of MIL-STD-282. The filter shall be placed on the machine with the faces and pleats in a vertical position. At the conclusion of the shaking period, the filter shall be visually examined for damage. Cause for rejection shall include cracked or warped cases, loose joints, cracked adhesive, loose or deformed media, separators, or grilles. After the rough handling test, the same filter shall meet the requirements in paras. FK-5110 and FK-5120.	FK-5130	The passive ventilation system for Single Shell Tanks at the Hanford site is not credited for containment in a seismic event. Seismic qualification of HEPA filters for SSTs is not required.  Flanders, the manufacturer of this filter, is an evaluated supplier for HEPA filters to the Hanford site. As such Flanders uses an NQA-1 qualified program for the manufacture, shipping, and storage of all HEPA filters. Further more CH2M HILL uses an NQA-1 qualified program for the receipt, transport, and storage of all HEPA filters on-site. This includes a very detailed receipt inspection of HEPA filters to verify that there is no shipping damage or manufacturer's defects in the filter prior to acceptance on site. Another inspection by CH2M HILL Quality Control is performed on every HEPA filter that is to be installed in the field to ensure that no damage has been missed or has occurred during transport or storage on site, this inspection is performed just prior to field installation to. This program provides assurance that all HEPA filters are handled, transported, and stored properly from the manufacturer through field installation, and therefore, ensures that a damaged filter will be rejected prior to field installation.	NA
36	Resistance to Pressure: The filter shall be tested for resistance to pressure on a machine capable of testing in accordance with Table FK-5000-4.  Prior to being tested for resistance to pressure, the filter shall be conditioned at atmospheric pressure for 24 hrs minimum in a chamber at 95° ± 5° F (35°C ± 3°C) and a relative humidity (RH) of 95% ± 5%.  After being conditioned, the filters shall withstand the airflow and water spray environment listed in Table FK-5000-4 without rupture of the filter media.  Within 15 min after completion of the pressure test and while still wet, the filter shall meet the requirement of FK-5120 at 20% airflow.	FK-5140	The conditions of this test are not representative of tank farm conditions. A differential pressure of 10 in w.g. is unobtainable under static, passive, conditions, a HEPA filter installed in this application will never experience flow rates high enough to generate 10 in w.g. of differential pressure across the filter.  There is no motive force to generate mist and carry entrained water droplets through the HEPA filter during passive conditions.	NA



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
37	<p>Resistance to Heated Air: For resistance to heated air, the filter shall be installed in the test chamber and subjected to 40% or greater rated flow of air heated to <math>700^{\circ}\text{F} \pm 50^{\circ}\text{F}</math> (<math>370^{\circ}\text{C} \pm 28^{\circ}\text{C}</math>) for no less than 5 min. Ramping to this temperature shall be accomplished in no more than 15 minutes.</p> <p>Following exposure to heated air and cooling of the filter in place, the filter shall be tested in accordance with FK-5120 at rated flow for test aerosol penetrations through the filter media, case, and gasket or gelatinous seal. The penetration shall not exceed 3% when tested in accordance with TA-4634.</p> <p>A label showing the traceable UL control number shall be objective evidence of compliance with FK-5150.</p>	FK-5150	The highest air temperatures in a single shell waste tank are approximately $180^{\circ}\text{F}$ . This temperature is in SX-114, and is taken in the waste. The dome space air temperatures of single shell tanks are significantly lower than this value, the air temperatures usually range from about $60^{\circ}\text{F}$ to $100^{\circ}\text{F}$ . A $700^{\circ}\text{F}$ air temperature test is unnecessary for filters that will not see temperatures above $150^{\circ}\text{F}$ in the worst-case scenario. This HEPA filter has a vendor rated maximum operating temperature of $250^{\circ}\text{F}$ .	NA
38	<p>Spot Flame Resistance: The filter is to be mounted in the test duct and the airflow adjusted to rated airflow. A gas flame from a Bunsen burner is to be directed against the upstream face of the unit. The Bunsen burner is to be adjusted to produce a flame with a blue cone <math>2\frac{1}{2}</math> in. (63 mm) long with a tip temperature of <math>1750^{\circ}\text{F} \pm 50^{\circ}\text{F}</math> (<math>955^{\circ}\text{C} \pm 25^{\circ}\text{C}</math>), as measured by a thermocouple inserted in the flame. The tip of the cone is to be so applied that it touches the surface of the filter media at a distance of not less than 2 in. (51 mm) from the filter case. The flame is to be applied for 5 min. at each of three separate locations on the filter face.</p> <p>The Bunsen burner flame then is to be directed into a top location on the filter unit in such a manner that the tip of the blue cone contacts the case, filter pack, and sealing materials. The flame is to be applied for a period of 5 min. The test is to be repeated upon the opposite top corner of the sample filter unit. After removal of the test flame at each point of application, there shall be no sustained flaming on the downstream face of the unit.</p> <p>Either an Underwriters' Laboratories label which through it traceable control number or UL-586 designation shall be acceptable objective evidence of compliance with FK-5160.</p>	FK-5160	There is no scenario for SST passive ventilation systems that would allow a breather filter to be exposed to direct flame.	NA

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
39	Qualification Testing for Type 2 Axial Flow Circular Filters	FK-5200 FK-5210 FK-5220 FK-5230 FK-5240 FK-5250 FK-5260	This is a Type 1 filter.	NA
40	Qualification Testing for Type 3 Axial Flow Rectangular or Circular Filters With Inlet And/Or Outlet Connection(s)	FK-5300	This is a Type 1 filter.	NA
41	Qualification Testing for Type 4 Axial Flow Rectangular Filters	FK-5400 FK-5410 FK-5420 FK-5430 FK-5440 FK-5450 FK-5460	This is a Type 1 filter.	NA
42	<p>Inspection:</p> <p>Each HEPA filter shall be visually inspected to show conformance to size specification, and to verify that the manufacturer's filter label indicates it has been tested at the flow rate of Tables FK-4000-1 through FK-4000-3 for Type 1, 2, or 3 filters. Type 4 filters are as specified on the filter label. Additional attributes to be inspected are height, width, depth, squareness, and adherence of gaskets.</p> <p>Gaskets shall be glued firmly and continuously to the case. Loose, peeling, or distorted gaskets shall be cause for rejection of the filter. The gasket on Type 4 filters shall not extend more than 1/16 in. (1.6 mm) over either side of the seating surface at any point. Edges of the gasket joint area shall be thoroughly coated with adhesive before assembly.</p>	FK-5500	Each filter is inspected prior to acceptance at the Hanford site, and is inspected again prior to installation.	CC
43	<p>PRODUCTION TESTING</p> <p>Production Testing of Type 1, Type 2, and Type 4 HEPA Filters:</p> <p>Each Type 1, 2, and 4 filter manufactured for delivery shall be tested for resistance to airflow and test aerosol penetration in accordance with:</p> <p>FK-5110 and FK-5120 for Type 1 filters FK-5210 and FK-5220 for Type 2 filters FK-5410 and FK-5420 for Type 4 filters</p> <p>Results shall be marked on the label of each filter.</p>	FK-5600 FK-5610	HEPA filter manufacturer Flanders, an evaluated supplier, tests each HEPA filter for resistance to airflow and aerosol penetration prior to shipment.	CC



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
44	Production Testing of Type 3 HEPA Filters:	FK-5620 FK-5621 FK-5622	This is a Type 1 Filter.	NA
45	FABRICATION General: The HEPA filter shall be assembled from the materials designated in Sub-article FK-3000 in accordance with the design requirements established in Article FK-4000. Following assembly, the filter shall be inspected and qualified in accordance with Article FK-5000. Production testing of qualified filters shall conform to FK-5600.	FK-6000 FK-6100	HEPA filter manufacturer Flanders, an evaluated supplier, fabricates the HEPA filters used to ASME AG-1 FK-6000	CC
46	Manufacturer and Assembly: The general requirements for fabrication and installation are contained in AA-6200 and AA-6300.	FK-6200	See referenced sections.	CC
47	TOLERANCES Flatness and Squareness: (a) Type 1 filter flange and end cap tolerances shall meet the following criteria: parallel within 1/16 in. (1.6 mm), square to the filter centerline axis to within 1/16 in. (1.6 mm) over the total filter length, flat within 1/16 in. (1.6 mm). (b) Type 2 filter tolerances shall meet the following criteria: ends parallel within 1/16 in. (1.6 mm), square to the filter centerline axis to within 1/16 in. (1.6 mm) over the total length, flat within 1/16 in. (1.6 mm). (c) Type 3 (Rectangular) and Type 4 filters tolerances shall meet the following criteria: faces of the case shall be flat and parallel to within a total allowance of 1/16 in. (1.6 mm). The case shall be square to within a total allowance of 1/8 in. (3mm) when measured diagonally across the corners of both faces. (d) Type 3 (Circular) filter tolerances shall meet the following criteria: faces of the case shall be flat and parallel to within a total allowance of 1/16 in. (1.6 mm).	FK-6210 FK-6211	HEPA filter manufacturer Flanders, an evaluated supplier, fabricates the HEPA filters used to ASME AG-1 FK-6000	NA

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
48	<p>Overall Dimensions:</p> <p>(a) Type 1 filter length shall be <math>\pm 1/16</math> in. (1.6 mm), filter seal ring diameter shall be <math>\pm 1/16</math> in. (1.6 mm), sealing face diameter <math>+1/32</math> in./-0 in. (+0.8 mm/-0 mm), concentricity shall be <math>1/16</math> in. (1.6 mm), all other dimensions <math>\pm 1/16</math> in. (1.6 mm).</p> <p>(b) Type 2 filters shall have diameters within <math>+1/8</math> in./-0 in. (+3 mm/-0 mm), and depths within <math>+1/16</math> in./-0 in. (1.6 mm/-0 mm).</p> <p>(c) Type 3 (Rectangular) filters shall be <math>+0</math> in./-1/8 in. (+0 mm/-3 mm) outside dimensions, except depth, which shall be <math>+1/16</math> in./-0 in. (+1.6 mm/-0 mm). The above dimensions exclude gaskets. Depth tolerances apply to both the completed unit and the filter case.</p> <p>(d) Type 3 (Axial Flow Circular) filters shall have diameters within <math>+0</math> in./-1/8 in. (+0 mm/-3 mm), and depths within <math>+1/16</math> in./-0 in., (+1.6 mm/-0 mm). The above dimensions exclude gaskets.</p> <p>(e) Type 4 filters outside dimensions shall be within <math>+0</math> in./-1/8 in. (+0 mm/-3 mm). Depth shall be within <math>+1/16</math> in./-0 in. (+1.6 mm/-0 mm). The above dimensions exclude gaskets.</p>	FK-6212	HEPA filter manufacturer Flanders, an evaluated supplier, fabricates the HEPA filters used to ASME AG-1 FK-6000	CC
49	<p>Media Installation:</p> <p>The filter media shall be fastened to the filter case or end-caps with adhesive to completely seal the edges of the media to the filter case. Patching of holes or tears in the media shall not be permitted.</p>	FK-6220	HEPA filter manufacturer Flanders, an evaluated supplier, fabricates the HEPA filters used to ASME AG-1 FK-6000	CC
50	<p>Workmanship:</p> <p>The filter shall be free from foreign matter (dirt, oil, or viscous material) and damage, such as distorted or cracked case, deformation or sagging of media, separators and faceguards, cracks in adhesive, and cracks or holes in exposed portions of the media. All the required fasteners shall be securely installed. All the dimensional and performance requirements of this Code Section are directed toward achieving the highest quality and workmanship possible.</p>	FK-6300	See FK-3150 and FK-4116. HEPA filter manufacturer Flanders, an evaluated supplier, fabricates the HEPA filters used to ASME AG-1 FK-6000	CC
	PACKAGING, SHIPPING, AND STORAGE	FK-7000		



Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter
51	<p>General: Packaging, shipping, and storage shall be in accordance with Article AA-7000 and ANSI/ASME NQA-2, Level B.</p> <p>HEPA filters shall be shipped under controlled conditions while maintaining protection of the goods in shipment to prevent damage, loss, or deterioration.</p> <p>HEPA filters shall be individually packaged. Cartons shall have extra shock absorbing material at the corners or edges of the filter that centers the filter within the carton to prevent damage.</p> <p>Type 1, Type 2, Type 3, and Type 4 filters shall be placed in the carton with the pleats vertical. The carton should be placed on skids or otherwise packed in such a manner that the pleats remain vertical during shipment.</p> <p>HEPA filters with gelatinous seals shall be packaged in a manner to prevent the gelatinous compound from sticking to the packaging material. A means shall be provided to prevent the gelatinous seal from being gouged or pulled out of the continuous channel when the filter is removed from the shipping carton/plastic bag.</p> <p>Cartons for HEPA filters shall not be stacked more than 6 ½ feet (2 m) high during packaging, shipping, handling, and storage.</p> <p>The HEPA filter carton shall be clearly marked for proper orientation per FK-9200.</p>	FK-7000	HEPA filter manufacturer Flanders, an evaluated supplier does packing, shipping, and storage of the HEPA filters used to ASME AG-1 FK-7000. When received at Hanford, the HEPA filters are managed at Hanford by a standard that complies with FK-7000.	CC
52	<p>QUALITY ASSURANCE</p> <p>General: Quality Assurance shall conform to the requirements of Article AA-8000 and the following:</p>	FK-8000 FK-8000	Flanders has been evaluated in accordance with the CH2M HILL NQA-1 quality assurance program and is an NQA-1 approved evaluated supplier of HEPA filters. Flanders states in their published literature (Flanders's Bulletin 936D page 2) that their Quality Assurance Program "meets the requirements of ANSI/ASME NQA-1 and 10CFR50 Appendix B," that should meet the requirements of AA-8000. See FK-8000.	CC
53	<p>Responsibility: The Manufacturer shall provide all specified information required by this Code to assure quality control. The Manufacturer shall perform all detailed examinations and tests required by this Code at the stages of construction necessary to permit them to be meaningful.</p>	FK-8100		CC

Item	Division II – Ventilation Air Cleaning and Ventilation Air Conditioning Requirement Text	Rqmt Source / Sec #	Requirement Compliance	Status Indicators: Flanders 40 cfm Filter C%
54	Certificate of Conformance: The Certificate of Conformance shall state that the filters conform to all requirements of ASME AG-1 Section FK.	FK-8200	The HEPA filter specification requires a Certificate of Conformance that meets these requirements. The Certificate of Conformance is shipped with the HEPA filters and is normally removed at Hanford receiving after verification that all items in specification / procurement were received.  Flanders is required to submit a Certificate of Conformance. In addition, Flanders is an evaluated supplier and has a record of manufacturing AG-1 compliant filters for Hanford applications. See FK-8000.	
55	NAMEPLATES Filter Marking: Marking or labeling of each filter shall be on the top of the filter when the plates are vertical. Letter size shall be 1/8 in. (3 mm) minimum. As a minimum, the following information shall be provided: (a) Manufacturer's name or symbol; (b) Model number; (c) Serial number; (d) Rated flow capacity; (e) Direction of airflow for penetration and pressure drop tests (Except Type 1 Filters); (f) Pressure drop (inches WC or Pascals) at 100% rated flow; (g) Overall penetration at rated flow; (h) Overall penetration and pressure drop (inches WC or Pascals) of complete assembly for Type 3 filters only (i) Overall penetration at 20% of rated flow; (j) UL label indicating successful testing per UL 586, if applicable. (k) Date of manufacture Package Marking: Marking or labeling of each shipping container (carton containing one filter) shall provide, as a minimum, the following information: (a) Manufacturer's name or symbol (b) Arrows and "THIS SIDE UP" indicating orientation for shipping and storage and "FRAGILE" in letters no less than 3/8 in. (10 mm) high (c) Filter model number (d) Purchase order number or other identifying mark requested by Purchaser	FK-9000 FK-9100	HEPA filter manufacturer Flanders provides nameplates of the HEPA filters used to ASME AG-1 FK-9000.	CC
56		FK-9200	HEPA filter manufacturer Flanders provides nameplates of the HEPA filters used to ASME AG-1 FK-9000.	CC



Attachment 2  
08-ESQ-175

Hanford Site Air Operating Permit, Notification of Off-Permit Change  
Permit Number: 00-05-006 Renewal 1

## **HANFORD SITE AIR OPERATING PERMIT**

### **NOTIFICATION OF OFF-PERMIT CHANGE**

**Permit Number: 00-05-006 Renewal 1**

This notification is provided to Washington State Department of Ecology, Washington State Department of Health, and the U.S. Environmental Protection Agency as a notice of an off-permit change described as follows.

This change is allowed pursuant to WAC 173-401-724(1), WAC 173-401-724(2), and WAC 173-401-724(6):

1. Change is not specifically addressed or prohibited by the permit terms and conditions,
2. Change does not weaken the enforceability of the existing permit conditions,
3. Change is not a Title I modification or a change subject to the acid rain requirements under Title IV of the FCAA,
4. Change meets all applicable requirements and does not violate an existing permit term or condition,
5. Change has complied with applicable preconstruction review requirements established pursuant to RCW 70.94.152.

Provide the following information pursuant to WAC-173-401-724(3):

#### **Description of the change:**

This revises, and supersedes the *Notice of Construction Application for Installation and Operation of a Breather Filter on Tanks 241-UX-302A, 241-AZ-154, and 241-U-301B*. The title has been changed to *Notice of Construction Application for Installation and Operation of Breather Filters on Miscellaneous Tanks* to accommodate future revisions incorporating additional Catch Tanks and other insignificant miscellaneous underground storage tanks (IMUSTs). This revision (Rev. 3) provides for the installation and operation of a breather filter on Catch Tank 241-S-302 and for its registration as an emission unit with an Air Emission Identification number (AEI) of P-S302-001. It also includes minor administrative changes for consistency and clarification.

**Date of Change:** (To be provided in the agency approval order.)

#### **Describe the emissions resulting from the change:**

241-S-302 catch tank is an existing unit whose emissions are largely fugitive. The addition of a breather filter will not actually increase emissions, but will channel them to a controlled point source. Administratively, the NOC will see an increase in the potential Annual Possession Quantity (APQ) and associated Potential to Emit (PTE) with the inclusion of the inventory in this additional catch tank. The PTE identified in the NOC changes from 2.73E-04 mrem/yr to 1.88E-01 mrem/yr. The abated emissions change from 2.73E-06 mrem/yr to 1.88E-03 mrem/yr.

**Describe the new applicable requirements that will apply as a result of the change:**  
(To be provided in the agency approval order.)

**For Hanford Use Only:**

AOP Change Control Number:

Date Submitted: